Soil Survey of

IMPERIAL COUNTY CALIFORNIA IMPERIAL VALLEY AREA

United States Department of Agriculture Soil Conservation Service

in cooperation with

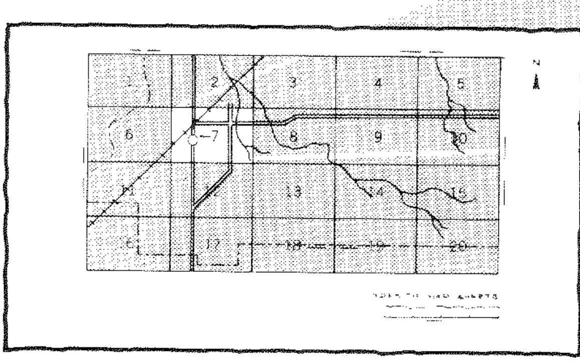
University of California Agricultural Experiment Station

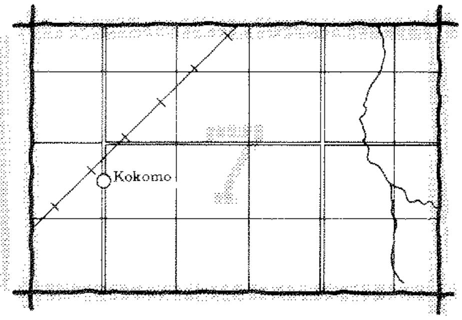
and

Imperial Irrigation District

HOW TO USE

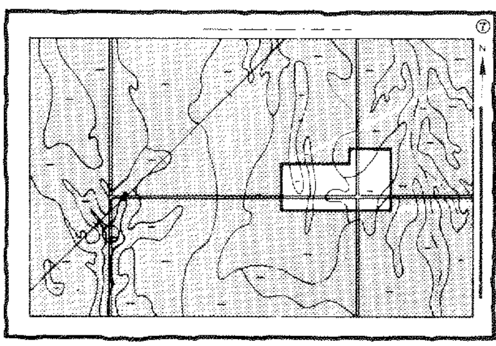
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

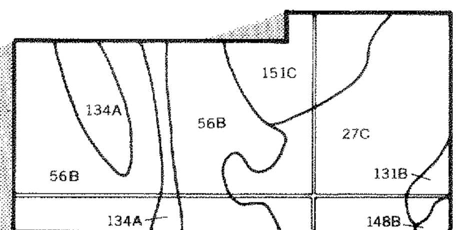




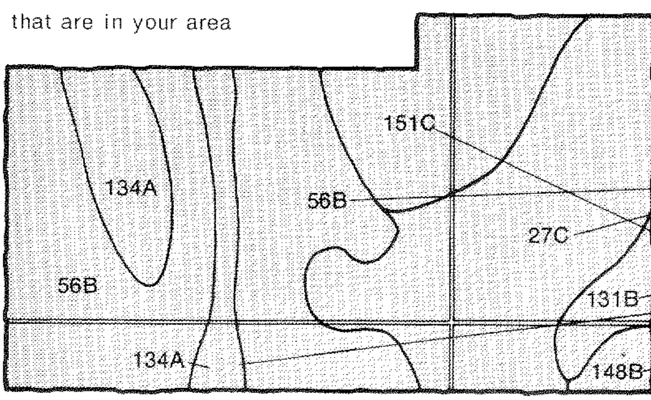
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area

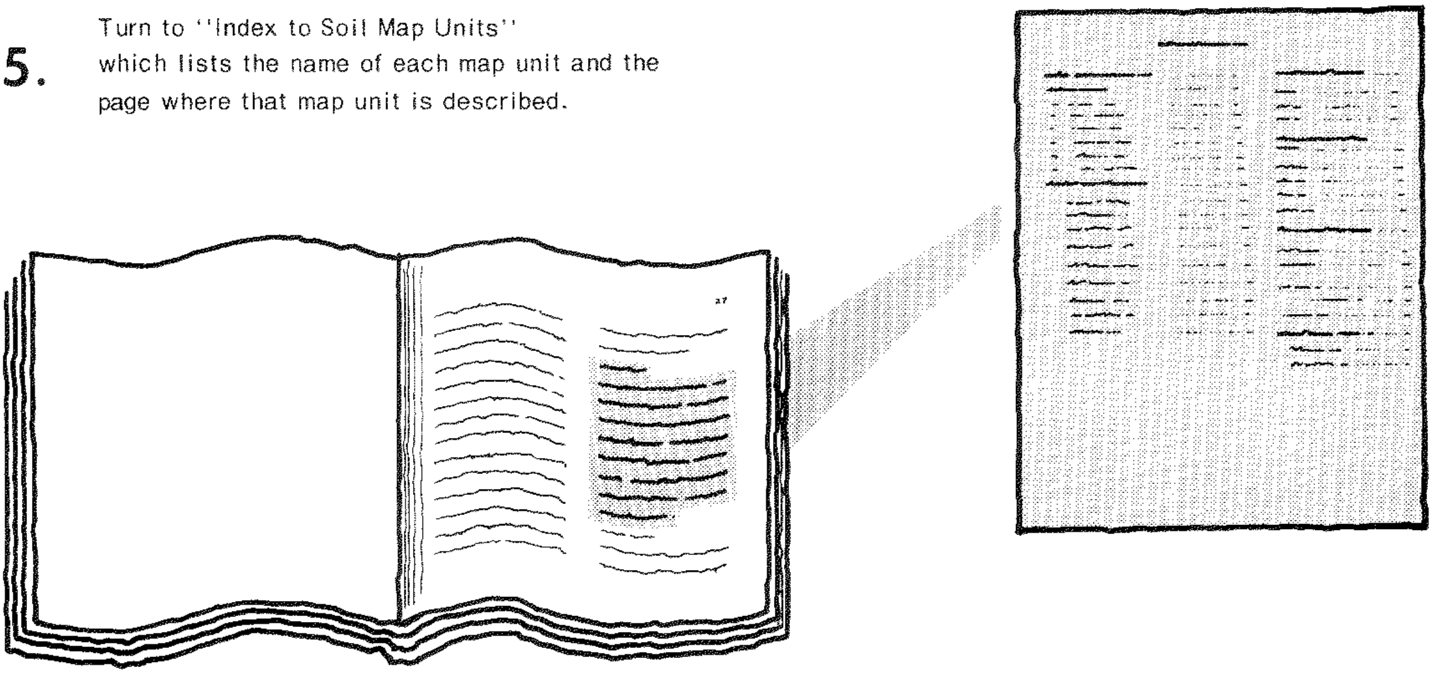


Symbols

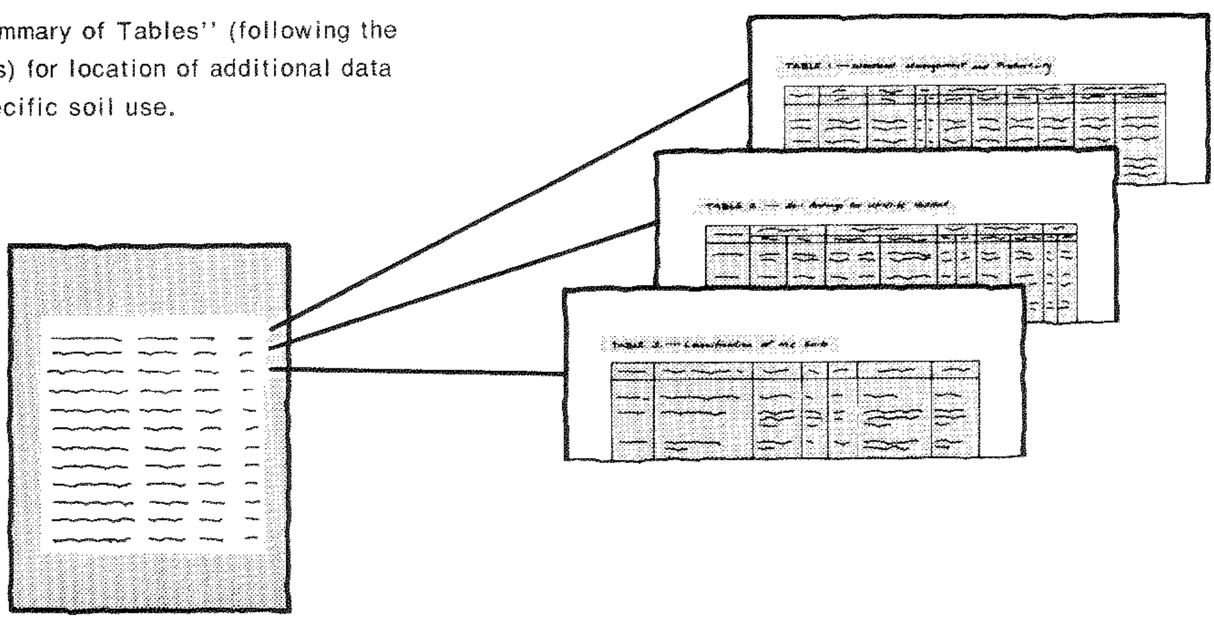
27C
56B
131B
134A
148B
151C

THIS SOIL SURVEY

5. Turn to ''Index to Soil Map Units'' which lists the name of each map unit and the page where that map unit is described.



6. See ''Summary of Tables'' (following the Contents) for location of additional data on a specific soil use.



7. Consult ''Contents'' for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1962-75. Soil names and descriptions were approved in August 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service and the University of California Agricultural Experiment Station. It is part of the technical assistance furnished to the Imperial Irrigation District, which acts as a resource conservation district.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: The survey area is outlined on a NASA photograph taken from Skylab 2 at an altitude of 270 miles. Dark spot at left is part of the Salton Sea. Cultivated area stretches south of the border of Mexico.

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Issued October 1981

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Preface

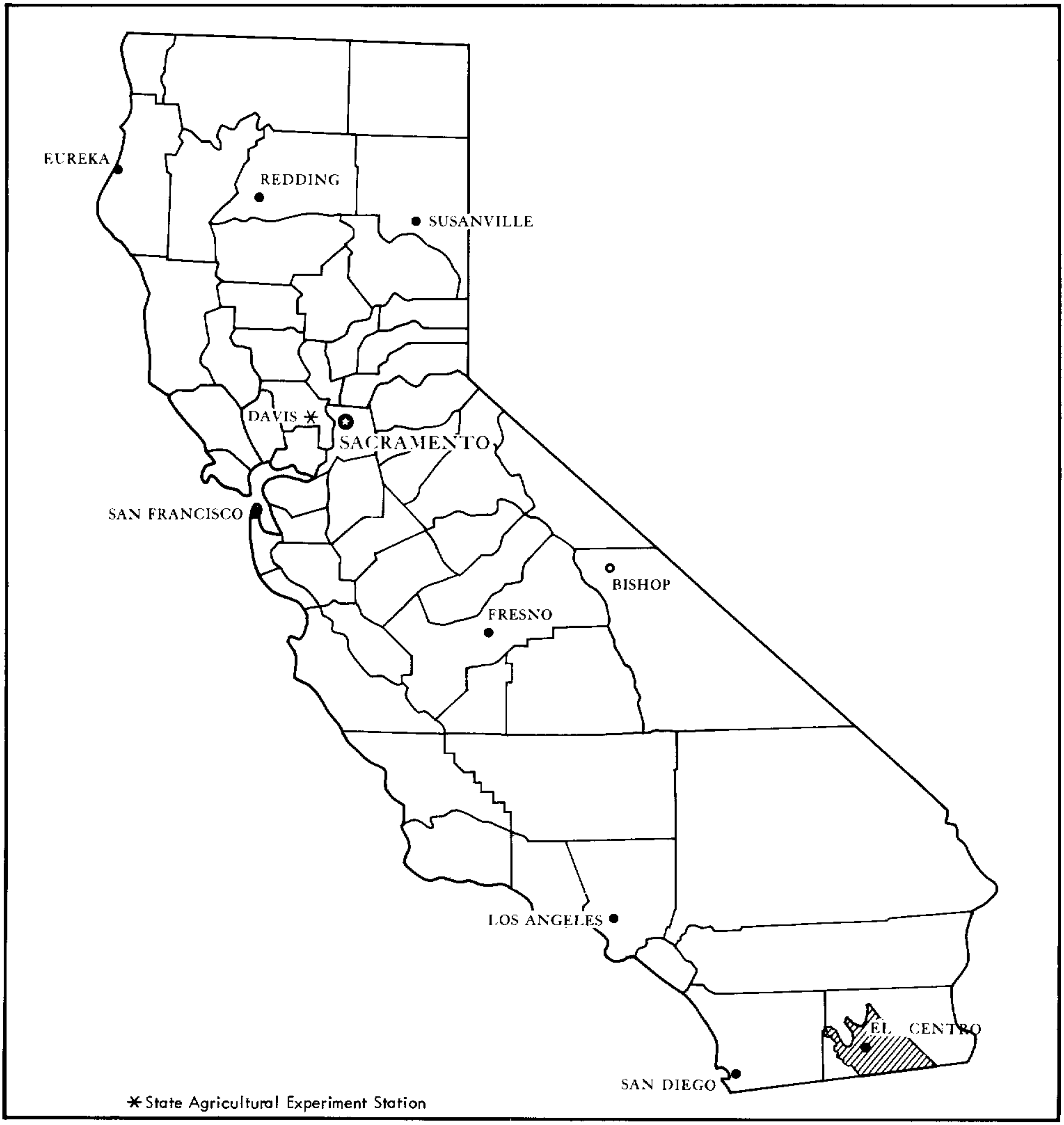
The Soil Survey of Imperial County, California, Imperial Valley Area, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.



Location of Imperial County, California, Imperial Valley Area.

SOIL SURVEY OF IMPERIAL COUNTY, CALIFORNIA, IMPERIAL VALLEY AREA

By Robert P. Zimmerman, Soil Conservation Service

Field work by Robert P. Zimmerman, Jason W. Decker, Albert S. Endo, Forrest W. Flannagan, James W. Lockard, John McAllaster, Robert G. Pratt, Guy J. Romito, Soil Conservation Service; Gerald Mitchell, Major Mitchell, Imperial Irrigation District

United States Department of Agriculture, Soil Conservation Service in cooperation with the University of California Agricultural Experiment Station and the Imperial Irrigation District

The Imperial Valley is in the southern part of California (see map on facing page). The survey area is in the south-central part of Imperial County, and is bounded by Mexico on the south, the Algodones Sand Hills on the east, the Salton Sea on the north, San Diego County on the northwest, and the alluvial fans bordering the Coyote Mountains and the Yuha Desert on the southwest. Elevation ranges from 230 feet below sea level to about 350 feet above. El Centro is the county seat and largest city of Imperial County, with a population of about 20,000. The Imperial Valley Area encompasses 989,450 acres.

Soils here are formed in stratified alluvial materials and vary greatly in texture and thickness of layers. Many soils are affected by soluble salts, and drainage is a problem in the irrigated areas.

A favorable climate plus water diverted from the Colorado River have enabled Imperial County's agricultural production to rank among the highest in California. Over 20 crops, as well as livestock and apiary products, brought high returns in 1975.

The soils of the Imperial Valley Area were first studied and mapped in 1901 and 1903 (*10, 11*). These studies considered the problems of salinity control and drainage and the management of such problems. The soils were more intensively mapped in 1922 and 1923 (*12, 13*), and the soils of the Imperial East Mesa were examined in 1944 (*16*). The present survey has been prepared to provide the more detailed information required by a rapidly developing and expanding agricultural and land-use technology.

General nature of the area

This section provides general information about the Imperial Valley Area. It discusses physiography, relief, and drainage; history and development; natural resources; and climate.

Physiography, relief, and drainage

The physiography of the Imperial Valley is that of a great basin. It is part of the northern extension of the giant geologic trough occupied by the Gulf of California. The portion of the basin within the survey area is bounded on the east by the Chocolate and Cargo Muchacho Mountains and on the west by the Coyote and Fish Creek Mountains. The Imperial Valley is separated from the Gulf of California by the ridge of the Colorado River delta, which is about 30 feet above sea level at its lowest point. The lowest part of the basin is the bed of the prehistoric Lake Cahuilla, where the beach line is about 35 feet above sea level. The deepest part of the lakebed, now filled by the Salton Sea, is about 270 feet below sea level. The shoreline of the Salton Sea was about 230 feet below sea level in 1974.

The main irrigated areas of the Valley are on the lakebed floor between the international boundary on the south and the Salton Sea on the north. This area is nearly level, with a slope toward the Salton Sea of about 0.1 percent. From the east and west edges toward the center, the slope is about 0.3 percent. The fine- and moderately fine-textured lakebed sediments are the parent materials of the Glenbar, Holtville, and Imperial soils and the underlying layers of the Meloland and Niland soils (fig.1). Windblown and river channel silts and sands deposited in the lake basin are the sources of the Indio, Vint, and Rositas soils and the surface layer of the Meloland soils. Rositas and Carsitas soils were formed in the beach deposits. Four low volcanic hills rise about 100 feet above the lakebed along the southeast edge of the Salton Sea.

Between the east side of the old lake basin and the Algodones Sand Hills is a desert plain, the Imperial East Mesa, which is a terrace of the Colorado River delta. This area is nearly flat, but slopes to the west about 0.1 percent near the southern edge of the international boundary. The grade increases slightly in the north part of the East Mesa, and is about 1.0 percent to the west in the area east of Calipatria. The surface of the East Mesa is hummocky or duned in many places where wind has redistributed the sandy terrace sediment. Local relief of the duned areas is commonly 10 to 25 feet between crests and interdune areas. The terrace sands are the parent materials of the Rositas and Superstition soils, and loamy terrace deposits are the parent materials of the Antho soils. The clayey material deposited in backswamps and ponded areas during formation of the delta terrace are the sources of the Holtville and Imperial soils.

The eastern boundary of the Imperial East Mesa is formed by the Algodones Sand Hills. The western edges of the Sand Hills, within the survey area, rise abruptly from the terrace floor on slopes of 10 to 15 percent. The first dune crests are 175 to 200 feet above the adjacent floor of the mesa. Sloping phases of the Rositas soil formed in the Sand Hills. The Sand Hills cut off the East Mesa from the west sloping fans of the Chocolate and Cargo Muchacho Mountains, and the East Mesa is entirely devoid of drainageways. The Sand Hills extend from below the international boundary on the south to Mammouth Wash on the north.

North of Mammouth Wash in the northeast part of the survey area, alluvial fans from the Chocolate Mountains spread out toward the Salton Sea (fig. 2). The fans slope approximately 0.33 percent to the southwest at the upper edge of the survey area. The grade diminishes downslope and is about 0.2 percent just below the old beachline. The sandy and gravelly fan materials are the parent materials of the Carsitas and Rositas soils. As the fans thinned at the lower edges over the clayey lakebed sediment, the Niland soils formed in the sandy over clayey strata. Runoff water from the fans have carved a network of sinuous parallel gullies 3 to 10 feet deep leading to the Salton Sea.

Another desert plain, the Imperial West Mesa, lies on the west side of the old lakebed. This nearly level plain takes in the basin floor east of the Coyote and Fish Creek Mountains, and includes the lower parts of the watersheds of Coyote Wash, Carrizo Creek, and San Felipe Creek. Between the central part of the West Mesa and the old lakebed are low uplands known as the Superstition Hills and Superstition Mountain. These uplands are not included in the survey area. On the West Mesa are some remnants of old dissected fans that have slopes as much as 3 percent. The fan sediment is the parent material of Antho, Laveen, Niland, and Superstition soils. Large areas of the West Mesa are sandy sediment deposited by intermittent streams from the mountains on the west. Carsitas and Vint soils formed in the recently deposited sands, and Rositas and Superstition soils formed on older, more stable sandy deposits. Playas and areas of moderately fine- or fine-textured basin deposits are the source materials of Glenbar, Holtville, and Imperial soils. At the edges of the playas and basins and in areas of deep eolian dust deposits are the silty materials in which the Indio soils formed.

The watersheds of the Imperial Valley Area all drain into the Salton Sea, which is a closed body with no outlet except for evaporation. The main inflow to the Salton Sea comes from the New and Alamo Rivers. These rivers flow north from the ridge of the Colorado River delta through the irrigated area of Imperial Valley and serve as outlets to a manmade trellis pattern of agricultural drains, which are their main source of water. The river gorges were widened and deepened by flooding in 1905-07, and in some places are entrenched 30 to 50 feet below the general surface of the lakebed (fig. 3). The river waters are somewhat saline, and the salinity of the Salton Sea is increasing as the salts are concentrated by evaporation.

On the West Mesa a network of intermittent streams carries storm runoff water eastward. The main drainageways south of Superstition Mountain are Coyote Wash, Yuha Wash, and Pinto Wash. These discharge through the constructed drainage network of the Imperial Irrigation District into the New River. North of Superstition Mountain the drainage of Carrizo Wash discharges into San Felipe Creek, which outlets directly into the Salton Sea.

History and development

The part of Imperial Valley below the 35-foot contour is the bed of Old Lake Cahuilla. Between the drying up of this lake about 600 years ago and the establishment of irrigated farming in 1900, the Imperial Valley area was an uninhabited desert waste. Indian tribes from the Coastal Range gathered mesquite beans and other foods here in the cooler months, but ascended to higher elevations in the summer. Indian trails of the Colorado River tribes and Coastal Range tribes crossed the area.

Juan Batista de Anza established a trail across the Valley in 1774 as part of an overland route from the Spanish settlements in Sonora, Mexico, to the settlements on the California coast. Branches of this part of the Old Spanish Trail were used by U. S. soldiers during the annexation of California, and by the 49'ers. At various times between 1850 and 1886, cattle from Texas and New Mexico were driven across the Valley to stock ranches in the Coastal Range. The Butterfield Stage Route crossed the area from 1858 until 1879, when the stage gave way to the railroad.

In 1849, Dr. Oliver Wozencraft crossed the area on his way to the goldfields, and noticed overflow waters of the Colorado River in the New and Salton (Alamo) Rivers. He was inspired with the idea of irrigating this desert area with Colorado River water. He spent the rest of his life and his personal fortune in an unsuccessful attempt to get legislative and financial backing for the project.

A land survey of the area north of the 4th Standard Parallel (about the latitude of the town of Heber) was made in 1854. However, many problems developed over land titles when the Valley was opened to homesteading under the Desert Entry Act. The Mexican Boundary Survey of 1892 laid out the lands south of the 4th Standard Parallel and established a good source for points of reference.

In 1879, the Southern Pacific Railroad was completed between Yuma and Los Angeles. The railroad passed through the north end of the old lakebed and established a maintenance camp at Old Beach, later Niland. Prior to 1900, the New Liverpool Salt Company shipped salt from surface deposits about 10 miles northwest of Old Beach.

In 1901, the California Development Company made the first delivery of irrigation water from the Colorado River through old delta channels in Mexico to the southern boundary of Imperial Valley. In that year and in 1903, scientists of the U. S. Bureau of Soils made extensive investigations of the newly opened lands (*10, 11*). Their report was pessimistic regarding immediate development of about three-quarters of the area because of the widespread salinity and lack of drainage outlets. However, by 1904 about 150,000 acres were under irrigation, with crops of barley, grain sorghum, alfalfa, and cantaloupe.

In 1905, floods on the Colorado River broke through the canal heading, and for almost 2 years the Colorado flowed into Imperial Valley, creating the Salton Sea and deeply entrenching the channels of the New and Salton (Alamo) Rivers. By the time the breach at the canal heading had been closed by the Southern Pacific Railroad, the California Development Company was greatly in debt to the railroad. Local citizens organized the Imperial Irrigation District in 1915, and the District purchased the assets of the California Development Company from the Southern Pacific.

The Imperial Irrigation District has maintained the water delivery system to the Imperial Valley since 1916, and in 1922 began a comprehensive drainage system that now offers a drainage outlet to each 160-acre parcel served with water.

The completion of Hoover Dam in 1935 solved the problem of water shortage caused by the fluctuations of river flow, and completion of the All-American Canal in 1942 eliminated the complication of water delivery through Mexico. However, the problems of a high water table and increasing salinity, predicted in 1901, had continued to build.

It was estimated that about one-quarter of the irrigable lands were adversely affected by salt and high water tables in 1919. By 1940, the Federal Land Bank of Berkeley had suspended loan-making in many areas of the Valley because of the salt and water table hazard. In this same year, an Imperial Valley Drainage Advisory Committee was formed with representatives of the Soil Conservation Service, Imperial Irrigation District, Farm Credit Administration, and the University of California. The committee supervised a 10-year investigation of drainage methods by technicians of the Soil Conservation Service and the Imperial Irrigation District (*4*). Satisfactory criteria for drainage and reclamation of salt-affected lands in the area were developed in this period. By 1974, over 20,000 miles of underground tile lines had been installed on private lands. Nearly 389,000 acres of the 445,000 irrigated acres are at least partially drained by tile systems.

Since 1949, more salt has been carried by drainage water to the Salton Sea than has been brought in by irrigation water. This favorable salt balance for the land of Imperial Valley indicates that a stable permanent agriculture can be maintained. It seems probable that a favorable salt balance will continue with little change in cropping pattern, even if the salinity of the irrigation water increases (*6*) from the present 900 parts per million (ppm) to 1,400 ppm dissolved salts.

Natural resources

Water for both irrigation and domestic use is brought by gravity canal from the Colorado River. The canal water is used for hydroelectric power generation at several drop structures. Most of the ground water is too saline for irrigation, although artesian well water was used for many years as a domestic water supply by some households east of the Alamo River. Attempts have been made to utilize the warm, mineralized ground water for health spas. One ranch in the San Felipe Creek drainage is irrigated by ground water.

The Valley is underlain by areas of geothermal activity that are potential sources of power and water. A large number of steam wells have been dug, providing a powerful output of steam and saline brine. This geothermal energy can be used to generate electric power and to desalinize ground water, but practical problems of corrosion and scale accumulation have limited its development. The saline brine is also a potential source of potassium, sodium, and calcium salts.

Carbon dioxide wells were operated in the north end of Imperial Valley during the 1930's.

Sand and gravel deposits of the ancient beach line are used as a source of construction, road building, and tile drain filter material. These deposits are limited, and some of these materials are now being brought in from the alluvial fans of the Coyote, Fish Creek, and Chocolate Mountains.

The Salton Sea is a large recreational fishing and water sports resource. However, the Sea's ability to maintain a fish population will decline rapidly in the next few years unless expensive measures are taken to keep salinity from increasing beyond levels in which fish can reproduce and live.

Large areas of waterfowl habitat are maintained around the edges of the Salton Sea by the U. S. Fish and Wildlife Service and the California Department of Fish and Game.

A gypsum products plant operates at Plaster City, about 25 miles west of El Centro. The gypsum beds are at the base of Fish Creek Mountain, and the quarried material is transported 25 miles by narrow gauge railway across the West Mesa to the Plaster City plant.

Climate

Assistance for this section was given by William B. Allen of the U. S. Fruit Frost Service, and Arnold J. MacKenzie and Robert D. LeMert of the U. S. Agricultural Research Service.

The climate of the Imperial Valley Area is arid, with hot summers and mild winters. Sunshine averages more than 8 hours a day, even in winter. Table 1 gives data on temperature and precipitation by month, as recorded at Imperial, California, for a period of more than 50 years. Table 2 shows probable dates at Imperial of last freezing temperatures in the spring and first freezing temperatures in the fall.

The average January air temperature at Imperial is about 54 degrees F. The average July air temperature is about 92 degrees. The average annual air temperature is about 73 degrees. The lowest minimum temperature recorded was 16 degrees on January 22, 1937. The highest temperature recorded, 119 degrees, occurred on 4 dates: July 14 and 16, 1936; July 25, 1943; and June 25, 1970.

The frost-free period at Imperial is more than 300 days in 9 out of 10 years, and is more than 350 days in 3 out of 10 years. On the average, there are about 8 days of frost per year at Imperial. Frost distribution, frequency, and intensity are somewhat variable within the irrigated area. Data from approximately 30 fruit frost temperature stations scattered throughout the valley show an average of 32 nights per year when the temperature drops to 32 degrees F at one or more stations. On the average, there are 2.3 nights in November, 10.5 nights in December, 13.5 nights in January, and 5.0 nights in February when the temperature drops to 32 degrees at one or more stations. In 3 years out of 25 there have been 50 or more nights when the temperature dropped to 32 degrees at one or more stations. Temperature differences between stations may be as much as 8 to 10 degrees, with data from Imperial (Table 2) representing one of the warmer stations.

Average annual precipitation at Imperial is about 2.8 inches. Precipitation distribution in Imperial Valley is uneven, but probably averages less than 3 inches for the entire area covered by this report. June is the driest month, usually having no precipitation. The highest rainfall for one day was recorded on September 6, 1939, when 4.08 inches was measured. September 1939 was the wettest month with 7.06 inches, and 1939 was the wettest year, with 8.52 inches. The only general snowfall of record fell on December 12, 1932, with 2 1/2 inches recorded at Imperial and 4 inches reported in the southeast part of Imperial Valley.

Prevailing winds are westerly in winter and spring. On windy days, velocities of 15 to 20 miles per hour are common, and some gusts exceed 30 miles per hour. Breezes in the hot months in summer usually have velocities below 15 miles per hour and tend to come from the southeast, bringing in humid air from the Gulf of California.

The average annual relative humidity is 29 percent in the Imperial Area. The most humid period is late in summer through winter. The average monthly relative humidity reaches a maximum of 40 percent in August and a minimum of 24 percent in March and April.

Evapotranspiration from growing crops can easily exceed 6 feet of water per year in this area. In the hot months in summer it may exceed 1/3 inch of water per day.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The 10 map units in this survey have been grouped into 2 general kinds of landscape for broad interpretive purposes. Both of these groups and the map units in each group are described in the following pages.

Well drained to poorly drained soils dominantly in the lacustrine basin

The soils in this group are dominantly in the lacustrine basin, but a few areas are on West Mesa. This area was formerly occupied by old Lake Cahuilla. The soils are nearly level. Elevation is about 230 feet below sea level adjacent to the Salton Sea and about 200 feet above sea level on West Mesa. The average annual precipitation is about 3 inches, and the average annual air temperature is about 72 degrees F. The average frost-free season is about 280 to 330 days.

These soils are very deep. They are mainly moderately well drained to well drained, but some soils adjacent to the Salton Sea are poorly drained. A perched water table is present in most soils in the basin because of seepage from canals and extensive irrigation. The surface layer ranges from gravelly sand to silty clay.

Soils in this group are used mainly for irrigated cropland. A few areas are used for urban and agro-industrial development, recreation, water impoundment, and desert wildlife habitat.

Six map units are in this group. They make up about 66 percent of the survey area.

1. Imperial

Nearly level, moderately well drained silty clay in the lacustrine basin

This map unit consists of very deep, calcareous soils formed in alluvial deposits. The largest area of the unit is around the town of Calipatria. Smaller areas are scattered throughout the lake basin. Natural drainage of soils has been altered by the seepage of water from irrigation canals and by extensive irrigation. Slopes are less than 2 percent. Elevation is about 230 feet below sea level to 30 feet above.

This unit makes up about 13 percent of the survey area. It is about 85 percent Imperial soils and 15 percent minor soils.

Imperial soils have a pinkish gray silty clay surface layer. Underlying this is pinkish gray and light brown silty clay.

Minor soils are the well drained Glenbar, Holtville, Meloland, and Indio soils.

Areas of this unit are mainly used for field crops and homesites.

The main management concerns for field crops are maintaining a favorable salt balance and keeping the water table below the root zone. Good irrigation management and proper use of tile drains are needed.

These soils are limited for the construction of homes mainly by the shrink-swell potential, low strength, and wetness. Septic tank absorption fields are limited by the perched water table and slow permeability. Foundations and septic tank absorption fields need to be specially designed.

2. Imperial-Holtville-Glenbar

Nearly level, moderately well drained and well drained silty clay, silty clay loam, and clay loam in the lacustrine basin

This map unit consists of very deep, calcareous soils formed in alluvial deposits throughout the lake basin. Natural drainage of soils has been altered by the seepage of water from irrigation canals and by extensive irrigation. Slopes are less than 2 percent. Elevation is about 230 feet below sea level to 30 feet above.

This unit makes up about 30 percent of the survey area. It is about 40 percent Imperial soils, 20 percent Holtville soils, 20 percent Glenbar soils, and 20 percent minor soils.

Imperial soils are moderately well drained. They have a pinkish gray silty clay loam or silty clay surface layer. Underlying this is pinkish gray and light brown silty clay.

Holtville soils are well drained. They have light brown silty clay loam or silty clay layers about 2 feet thick. Underlying these are stratified very pale brown silt loam and loamy very fine sand.

Glenbar soils are well drained. They have a pinkish gray clay loam or silty clay loam surface layer. Underlying this is stratified light brown clay loam and silty clay loam.

Minor soils are the well drained Meloland, Indio, and Vint soils, and the somewhat excessively drained Rositas soils.

Areas of this unit are used mainly for field and vegetable crops. A few areas are used for homesites.

The main management concerns for field or vegetable crops are maintaining a favorable salt balance and keeping the water table below the root zone. These require good irrigation management and proper use of tile drains.

These soils are limited for the construction of homes mainly by the shrink-swell potential, low strength, and wetness. Septic tank absorption fields are limited by the perched water table and slow permeability. Foundations and septic tank absorption fields require special design.

3. Meloland-Vint-Indio

Nearly level, well drained fine sand, loamy very fine sand, fine sandy loam, very fine sandy loam, loam, and silt loam in the lacustrine basin and on low alluvial fans

This map unit consists of very deep, calcareous soils formed in alluvial deposits and in eolian material. About two-thirds of this unit is in the lacustrine basin and the remaining part is on low fans of West Mesa. Natural drainage of soils in the basin area has been altered by the seepage of water from irrigation canals and by extensive irrigation. Natural vegetation in the desert areas is a sparse scattering of creosotebush, mesquite, and ephemeral herbs and grasses. Slopes are less than 2 percent. Elevation is about 230 feet below sea level to about 200 feet above.

This unit makes up about 16 percent of the survey area. It is about 30 percent Meloland soils, 25 percent Vint soils, 20 percent Indio soils, and 25 percent minor soils.

Meloland soils have a light brown very fine sandy loam or fine sand surface layer. Underlying this is stratified very pale brown loamy fine sand and silt loam to a depth of about 2 feet. Below this is pink silty clay.

Vint soils have a light brown loamy very fine sand, fine sandy loam, or very fine sandy loam surface layer. Underlying this is stratified pink and light brown loamy fine sand.

Indio soils have a pinkish gray loam or very fine sandy loam surface layer. This is underlain by stratified very pale brown and pink layers of silt loam and loamy very fine sand.

Minor soils are the somewhat excessively drained Rositas soils and the well drained Holtville, Antho, and Glenbar soils.

Areas within the basin that have water available for irrigation are mainly used for field or vegetable crops, and to a limited extent for citrus. Areas on the mesa lack water for irrigation and are used for desert recreation or as wildlife habitat.

The main management concerns for irrigated crops is maintaining a favorable salt balance and keeping the water table below the root zone.

4. Niland-Imperial

Nearly level, moderately well drained gravelly sand, fine sand, silty clay, and silty clay loam at the edges of the lacustrine basin

This map unit consists of very deep, calcareous soils formed in alluvial or eolian deposits. The largest acreage is along the northeastern edge of the survey area around the town of Niland. Smaller areas are along the western edge of the basin, adjacent to West Mesa. Natural drainage has been altered in extensively irrigated areas, and water may be perched within the root zone of most crops. Natural vegetation in areas not irrigated is a sparse scattering of creosotebush and wingscale, with ephemeral herbs and grasses. Slopes are 0 to 2 percent. Elevation is about 200 feet below sea level to 200 feet above.

This unit makes up about 4 percent of the survey area. It is about 60 percent Niland soils, 20 percent Imperial soils, and 20 percent minor soils.

Niland soils have a stratified very pale brown gravelly sand or fine sand surface layer. Underlying this to a depth of about 2 feet is pale brown silty clay.

Imperial soils have a pinkish gray silty clay or silty clay loam surface layer. Underlying this is light brown and pinkish gray silty clay.

Minor soils are the well drained Meloland, Glenbar, and Holtville soils, and the somewhat excessively drained Rositas soils, the excessively drained Carsitas soils, and a few small areas of Badland.

Most areas of this unit are used for desert recreation or as wildlife habitat. Where water is available for irrigation a few areas are used for field or vegetable crops, though most land is left idle because of the marginal economics of development.

In desert recreation areas, vehicles need to stay on existing trails and roads to help reduce the hazard of erosion.

The main management concerns for cropland are maintenance of a favorable salt balance and control of the water table to keep it at a depth below the root zone.

5. Glenbar-Imperial

Nearly level, well drained and moderately well drained silt loam, clay loam, silty clay loam, sand, fine sand, and silty clay dominantly in basins on West Mesa

This map unit consists of very deep, calcareous soils formed in alluvial deposits scattered throughout West Mesa. Most areas are barren or support scattered salt-tolerant ephemerals. Slopes are 0 to 2 percent. Elevation is 150 feet below sea level to 200 feet above.

This unit makes up about 2 percent of the survey area. It is about 60 percent Glenbar soils, 25 percent Imperial soils, and 15 percent minor soils.

Glenbar soils are well drained. Typically, they have a pinkish gray clay loam or silty clay loam surface layer. Underlying this is stratified light brown clay loam and silty clay loam. In some areas the surface layer is highly variable and ranges from sand to silty clay loam.

Imperial soils are moderately well drained. They have a pinkish gray silty clay or silty clay loam surface layer. Underlying this is pinkish gray and light brown silty clay.

Soils of minor extent are the well drained Meloland, Holtville, Indio, and Vint soils and the somewhat excessively drained Rositas soils.

Areas of this unit are used for desert recreation and as desert wildlife habitat.

In desert recreation areas, vehicles need to stay on existing trails and roads to help reduce the hazard of erosion.

6. Fluvaquents

Nearly level, poorly drained soils of undifferentiated texture in the lacustrine basin

This map unit consists of saline soils formed in alluvium. Areas are along the edge of the Salton Sea. The soil is mainly covered by saltcedar, pickleweed, iodine weed, and saltgrass. Slopes are less than 1 percent. Elevation is about 220 to 230 feet below sea level.

This unit makes up about 1 percent of the survey area. It is about 95 percent Fluvaquents and 5 percent minor soils.

Fluvaquents are very deep and strongly saline. They have stratified layers ranging from silty clay to fine sand. The water table is at a depth of 3 feet below the surface most of the year.

Minor soils are the somewhat excessively drained Rositas soils, which are on dunes.

This unit is used for wetland wildlife habitat. The soil lacks drainage outlets for reclamation and is subject to flooding if the Salton Sea rises.

Well drained and somewhat excessively drained soils dominantly on East Mesa and on West Mesa

The soils in this group are dominantly on the mesas adjacent to the old Lake Cahuilla basin. The soils are nearly level to moderately steep. Elevation is about 30 feet near the edge of the basin to about 350 feet in the sandhills on East Mesa. The average annual precipitation is about 3 inches, and the average annual air temperature is about 72 degrees F. The average frost-free season is about 300 to 330 days.

These soils are very deep. They are well drained to somewhat excessively drained. The surface layer ranges from sand to silty clay.

Soils in this group are mainly used for desert recreation or as desert wildlife habitat.

Four map units are in this group. They make up about 34 percent of the survey area.

7. Rositas

Nearly level to moderately steep, somewhat excessively drained sand, fine sand, and silt loam in alluvial basins and on fans and sandhills

This map unit consists of very deep, calcareous soils formed in alluvial and eolian deposits. The areas are on both the East and West Mesas. The plant cover includes shrubs of creosotebush, ephedra, white bursage, wingscale, and desert buckwheat, with big galleta grass and numerous ephemerals. Slopes are 0 to 30 percent. Elevation is 30 to 350 feet above sea level.

This unit makes up about 20 percent of the survey area. It is about 85 percent Rositas soils and 15 percent minor soils.

Rositas soils have a reddish yellow sand, fine sand, or silt loam surface layer. Underlying this is reddish yellow fine sand.

Minor soils are the well drained Vint, Meloland, and Indio soils; the moderately well drained Niland soils; the somewhat excessively drained Superstition soils; and the excessively drained Carsitas soils.

Areas of this unit are mainly used for desert recreation and as desert wildlife habitat. Some parts are sources of sand and gravel. A few areas of the Rositas soils are used for field or vegetable crops and citrus.

In desert recreation areas, vehicles need to stay on existing trails, roads, and dune areas. This will help to limit soil blowing in areas.

8. Rositas-Superstition

Nearly level, somewhat excessively drained loamy fine sand or fine sand on alluvial terraces and fans

This unit consists of very deep, calcareous soils formed in eolian or alluvial material. Areas are on East Mesa. Natural vegetation is a sparse cover of creosotebush, ephedra, white bursage, and wingscale. Slopes are 0 to 2 percent. Elevation is 30 to 300 feet above sea level.

This map unit makes up about 11 percent of the survey area. It is about 68 percent Rositas soils, 12 percent Superstition soils, and 20 percent minor soils.

Rositas soils have a reddish yellow fine sand or loamy fine sand surface layer. This is underlain by reddish yellow fine sand.

Superstition soils have a pink loamy fine sand surface layer. This is underlain by pink and pinkish white sand and loamy fine sand.

Minor soils are the well drained Antho, Holtville, and Vint soils.

Areas of this unit are mainly used for desert recreation and as desert wildlife habitat.

In desert recreation areas vehicles need to stay on existing trails and roads to help prevent erosion.

9. Antho-Superstition-Rositas

Nearly level, well drained and somewhat excessively drained fine sand and loamy fine sand in alluvial basins and on alluvial fans and terraces

This map unit consists of very deep, calcareous soils formed in alluvial and eolian deposits. Most areas are on West Mesa. Natural vegetation is creosotebush and desert ephemerals. Slopes are 0 to 2 percent. Elevation is 40 to 250 feet above sea level.

This unit makes up about 2 percent of the survey area. It is about 30 percent Antho soils, 25 percent Superstition soils, 15 percent Rositas soils, and 30 percent minor soils.

Antho soils are well drained. They are on terraces and in basins. The surface layer is reddish yellow loamy fine sand. This is underlain by stratified reddish yellow or pink fine sandy loam, loamy very fine sand, and very fine sandy loam to a depth of about 42 inches. Below this, the stratum includes finer textures.

Superstition soils are somewhat excessively drained. They are on alluvial fans and terraces. The surface layer is pink loamy fine sand and fine sand. This is underlain by pink and pinkish white sand and loamy fine sand.

Rositas soils are somewhat excessively drained. They are on alluvial terraces and fans. The surface layer is reddish yellow fine sand or loamy fine sand. This is underlain by reddish yellow fine sand.

Minor soils are the well drained Laveen, Vint, Indio, and Meloland soils; the moderately well drained Niland soil; and the excessively drained Carsitas soil.

Areas are used for desert recreation, as desert wildlife habitat, and as military test ranges.

In desert recreation areas vehicles need to stay on existing trails and roads to help prevent erosion.

10. Holtville-Antho

Nearly level, well drained loamy fine sand, loam, silty clay loam, and silty clay on alluvial terraces

This map unit consists of very deep, calcareous soils formed in alluvial sediment. Areas are on East Mesa. The soils are nearly barren. The sparse natural vegetation is creosotebush and desert ephemerals. Slopes are 0 to 2 percent. Elevation is 30 to 200 feet above sea level.

This unit makes up about 1 percent of the survey area. It is about 40 percent Holtville soils, 20 percent Antho soils, and 40 percent minor soils.

Holtville soils have a light brown loam, silty clay loam, or silty clay surface layer. This is underlain by light brown and very pale brown silt loam and loamy very fine sand.

Antho soils have a reddish yellow loamy fine sand surface layer. This is underlain by reddish yellow and pink fine sandy loam, loamy very fine sand, and very fine sandy loam.

Minor soils are the well drained Vint and Glenbar soils, the moderately well drained Niland and Imperial soils, and the somewhat excessively drained Rositas and Superstition soils.

Areas of this unit are used for desert recreation, as desert wildlife habitat, and as military ordnance ranges. A few places are sources of clay for road base and canal lining.

In desert recreation areas vehicles need to stay on existing trails and roads to help prevent erosion.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Holtville series, for example, was named for the town of Holtville in Imperial County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Niland gravelly sand, wet, is one of several phases within the Niland series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Indio-Vint complex is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Meloland and Holtville loams, wet, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Badland is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Soil descriptions and potentials

The climatic setting for all soils of the survey area is very similar. The average annual rainfall is about 3 inches, average annual air temperature is about 72 degrees F, and average frost-free season is about 300 days.

In this dry climate the soils have no potential for farming and only limited potential for wildlife habitat, unless they are irrigated. Dryland capability of all soils is Land Capability Class VIII. The soils are placed in Land Capability Units on the basis of their potential for farming, assuming an adequate quantity of Colorado River water is available or that water of equivalent quality can be made available.

100—Antho loamy fine sand. This very deep, well drained, nearly level soil is on terraces and in basins at an elevation of 40 to 350 feet (fig. 4). It formed in alluvial sediment of mixed sources.

Included with this soil in mapping are about 5 percent Holtville loam and about 5 percent Laveen loam. About 600 acres of the unit is a soil similar to this Antho soil which has discontinuous, hard and brittle, lime-cemented lenses about 1/2 inch thick. Surface textures of fine sandy loam and silt loam are typical of blow-out areas.

Typically, the surface layer of this Antho soil is reddish yellow loamy fine sand about 13 inches thick. Underlying this is stratified reddish yellow or pink fine sandy loam, loamy very fine sand, and very fine sandy loam to a depth of 42 inches. Below this is stratified, contrasting material of finer or coarser texture. Soft masses and concretions of lime are in some layers between the surface and a depth of 40 inches. Some areas are moderately saline. In some areas 20 to 30 inches of sand is on the surface; in other areas sand or loamy sand is at a depth of 20 to 36 inches.

Permeability is moderately rapid, and available water capacity is low to moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The effective rooting depth is 60 inches or more.

This map unit is used for desert recreation.

This soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Land smoothing for sprinkler irrigation or land leveling for surface irrigation is needed for cultivation. For efficient surface irrigation, fields need to be leveled to a grade between 0.2 and 0.3 percent per 100 feet, with runs of 400 to 500 feet. Initial leaching is needed in some areas to reduce soluble salts. Development of a perched water table is possible. Widely spaced or moderately spaced tile drains help to control salinity and lower the water table. Proper crop residue use and minimum tillage help to control soil blowing.

If irrigated, this soil is suited to all field and vegetable crops common to the area.

This Antho soil is suited to homesites and urban areas. The sandy surface layer and low available water capacity are the main limiting features for this use. Revegetating disturbed areas around construction sites helps to control soil blowing. Desert plants and other drouth-tolerant species are best suited for landscaping.

Septic tank absorption fields can function well in this soil. Ground water contamination is a hazard because of the moderately rapid permeability. If a perched water table develops from heavy use of absorption fields, moderately spaced tile drains can be effective. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the drain.

Ponds and reservoirs constructed in this soil can develop seepage unless they are sealed or lined.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIs-4, irrigated, and capability subclass VIIe, dryland. The Storie index rating is 85.

101—Antho-Superstition complex. These nearly level soils formed in mixed terrace sediment. Most areas are on Imperial West Mesa, but small areas are on Imperial East Mesa. Elevation is 40 to 300 feet.

The Antho and Superstition soils are so intricately mixed that they were not separated in mapping.

Antho loamy fine sand is about 55 percent of this unit, and Superstition fine sand is about 25 percent. The remaining 20 percent is Carsitas, Laveen, Niland, Vint, Indio, Rositas, and Meloland soils.

The Antho soil is very deep and well drained. It formed in alluvial terrace deposits from diverse sources. Typically, the surface layer is very pale brown loamy fine sand about 8 inches thick. Underlying this is pink and reddish yellow loamy very fine sand, very fine sand, and fine sand to a depth of 45 inches. Below this is pink fine sand and a few lenses of silty clay. In areas, the surface layer contains soft masses and concretions of lime, which is not typical for the Antho series. Some areas are moderately saline, and some areas have 20 to 36 inches of fine sand on the surface.

Permeability of the Antho soil is moderately rapid, and available water capacity is low to moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The effective rooting depth is 60 inches or more.

The Superstition soil is very deep and somewhat excessively drained. It formed in sandy alluvial sediment of diverse origin. Typically, the surface layer is pink fine sand about 6 inches thick. Underlying this is pink loamy fine sand about 11 inches thick that contains about 6 percent soft masses and concretions of lime. Below this, to a depth of several feet, is pink and pinkish white sand that has very few lime masses or concretions below a depth of 36 inches.

Permeability of the Superstition soil is moderately rapid, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The effective rooting depth is 60 inches or more.

These soils are used for desert recreation and military ordnance impact areas.

There is potential for irrigated farming, but development depends on an adequate supply of good quality water. Land smoothing for sprinkler irrigation or land leveling for surface irrigation is needed to properly irrigate these areas. For efficient surface irrigation, fields need to be leveled to a grade between 0.2 and 0.3 percent in 100 feet, with runs of 300 feet or less. Initial leaching is needed in some areas to reduce soluble salts. Development of a perched water table is possible. Moderately spaced tile drains help to control salinity and to lower the water table. Proper crop residue use and minimum tillage help to control soil blowing.

If irrigated, these soils are suited to all climatically adapted crops, including citrus. These soils wash easily from carrots and onions. Incorporation of barnyard manure and crop residue improves the water- and nutrient-holding capacities.

These soils are suited to homesites and urban areas. The sandy surface layer and low or moderate available water capacity are the main limiting features for this use. Revegetating disturbed areas around construction sites helps to control soil blowing. Desert plants and other drouth-tolerant species are best suited for landscaping.

Septic tank absorption fields can function well. Ground water contamination is a hazard because of the moderately rapid permeability. If a perched water table develops from heavy use of absorption fields, moderately spaced tile drains can be effective. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain.

Ponds or reservoirs constructed in this unit can develop seepage unless they are sealed or lined.

These soils have poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIs-4, irrigated, and capability subclass VIIe, dryland. The Storie index rating is 77.

102—Badland. This steep to very steep miscellaneous area consists of barren land on unconsolidated, stratified alluvium. It is dissected by drainageways. Local differences in elevation are more than 25 feet. This unit includes the bluffs of the New and Alamo Rivers and areas on the edges of West Mesa. Texture of the materials forming the Badlands ranges from clay to gravelly sand, but strata of fine textures predominate. In many places strata are inclined from the horizontal.

Included with this unit in mapping are some areas of gullied Torriorthents and Orthids that have slopes of 9 to 30 percent and local relief of less than 25 feet. Also included are areas of Imperial, Holtville, Meloland, and Indio soils.

Surface runoff is rapid or very rapid, and the hazard of erosion is high. On the river bluffs, erosion control measures can prevent head-cutting of gullies into adjacent cultivated land.

This miscellaneous area is used for wildlife habitat and recreation. Other uses and potentials are restricted by the steep slopes and rapid geologic erosion.

This map unit is in capability subclass VIIIe, dryland. The Storie index rating is less than 10.

103—Carsitas gravelly sand, 0 to 5 percent slopes. This very deep, excessively drained soil is on alluvial fans, beach ridges, and the bottoms of washes. It formed in mixed alluvial materials weathered from granitic and metamorphic rocks. Elevation is 200 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of Rositas, Niland, Superstition, and Antho soils, and a few small areas of very gravelly, cobbly, stony, or very stony soils. Also included are areas of Carsitas soils that have short slopes of 5 to 15 percent, and about 125 acres of a wet Carsitas gravelly sand west of Niland. In the lower Borrego Valley this unit adjoins a soil that is similar and mapped in San Diego County as Carrizo very gravelly sand, 0 to 9 percent slopes. The area where these soils join is a transition zone from gravelly to very gravelly sand, and the small areas of very gravelly sand in Imperial County are included in this unit.

Typically, the surface layer of this Carsitas soil is pink gravelly sand about 10 inches thick. Underlying this is stratified very pale brown sand, coarse sand, gravelly sand, and gravelly coarse sand to a depth of 68 inches.

Permeability is rapid, and available water capacity is very low or low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. Flooding is a hazard in a few areas. The effective rooting depth is 60 inches or more.

This soil is a source of sand. Some very gravelly soils included in this unit are sources of gravel. This soil is also used for desert recreation.

This soil has potential for such deep-rooted, high value crops as grapes and citrus. Because this soil is sandy and droughty, it requires such special irrigation methods as sprinklers or drip emitters to apply water efficiently. Frequent irrigation is needed during hot periods in summer. Occasional excess applications of water for leaching can prevent salt accumulation. If a perched water table develops, widely spaced tile drains are required to control salinity and to lower the water table. Incorporation of barnyard manure or crop residue improves the moisture- and nutrient-holding capacities. Use of a cover crop between trees or grapes helps control soil blowing.

This Carsitas soil is suited to homesites and urban areas. Sandy soil and rapid permeability are basic features affecting these uses. Revegetating disturbed areas around construction sites helps to control soil erosion. Desert plants and other drought-tolerant species are best adapted for landscaping.

Septic tank absorption fields can function well, but contamination of the ground water is possible because of rapid permeability.

This soil is too permeable for construction of water impoundments. Ponds and reservoirs need an impervious lining to prevent seepage.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IVs-4, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 26.

104—Fluvaquents, saline. This unit consists of very deep, nearly level soils on flood plains and alluvial basin floors. Most areas are on low flood plains of the New and Alamo Rivers and along the edge of the Salton Sea. Texture ranges from silty clay to fine sand. The water table is within a depth of 36 inches most of the year. Soluble salts are concentrated in the surface layer by capillary rise and evaporation of the saline ground water. Elevation is 150 feet above sea level to 230 feet below.

Included with these soils in mapping are a few dunes and hummocks of better drained soils, mainly Rositas fine sand, which make up about 5 percent of the unit. An area of about 110 acres near Red Hill has been diked for evaporation ponds for steam-well effluent.

Surface runoff on the Fluvaquent soils is slow to ponded, and the hazard of erosion is slight. Flooding is a hazard in some areas. Soluble salt accumulation is too great for crop production.

Potential is poor for cropland because of strong salinity and poor drainage. Gravity outlets for drainage are not available. Flooding is a hazard in places.

The unit is poorly suited to urban development because of the high water table, flood hazard, and salinity.

Potential is fair as habitat for such upland wildlife as cottontail rabbits, black-tailed jackrabbits, California quail, and mourning dove. Scattered saltcedar, pickleweed, iodine weed, and arrowweed produce some cover for wildlife, and saltgrass, mesquite, and baccharis produce some food.

These soils have potential for such wetland wildlife as ducks and bullfrogs. Dugout ponds fill to the level of the water table, which generally is 1 to 3 feet below the natural surface. However, lack of drainage outlets prevents management of water level and limits establishment of food plants.

This map unit is in capability subclass VIIIw, dryland. The Storie index rating is 3.

105—Glenbar clay loam. This very deep, well drained soil is mainly on the floors of alluvial basins in dissected playas or on the edges of playas on West Mesa. It formed in alluvial sediment of mixed origin. Areas are 3 to 200 acres in size. Elevation is 200 feet above sea level to 230 feet below.

Included with this soil in mapping are areas of Indio, Imperial, Meloland, and Niland soils. Also, areas of this Glenbar soil border these soils.

Typically, the surface layer of this Glenbar soil is pinkish gray clay loam about 13 inches thick. Underlying this is stratified light brown clay loam and silty clay loam to a depth of 60 inches. In some places, windblown sand covers the surface layer. In other areas this soil is stratified with coarser textured materials.

Permeability is moderately slow, and available water capacity is very high. Surface runoff is slow, and the hazard of erosion is slight, although many areas are channeled by geologic erosion. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

The soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Certain measures are needed: land leveling for surface irrigation; land smoothing for sprinkler irrigation; in most areas, an initial leaching for toxic salt reduction; and in most areas, moderately spaced underground drains to provide leaching outlets and to prevent a high water table.

If irrigated, this soil is suited to general field crops, winter vegetables, and melons. Alfalfa stands are difficult to maintain because of temporary anaerobic conditions after irrigation. The soils are sticky and difficult to remove from such crops as carrots and onions. Because of the difficulty of maintaining a good salt balance without water-logging the root zone, the soil is poorly suited to citrus. Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake.

This Glenbar soil is moderately suited to homesites and urban areas despite such limitations as high clay content and salinity. House slabs and footings need extra strength to withstand the stresses of shrinking and swelling and to compensate for the low bearing strength of this soil. Backfilling the base area with a compacted layer of nonplastic soil and irrigating the area to maintain a constant moisture level also help reduce stress to house slabs.

Salt-tolerant plants are better suited to landscaping than most other plants.

Septic tank absorption fields present difficulties because of permeability and probable development of a perched water table. Tile drainage prevents or reduces the water table condition, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench help compensate for the moderately slow permeability. A central sewage system is better for homes than a septic tank system.

This soil is suited to such water impoundment areas as reservoirs and fish ponds. If permeable layers are exposed by pond excavation, these need to be sealed during construction. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, the soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit I, irrigated, and capability subclass VIIIC, dryland. The Storie index rating is 58.

106—Glenbar clay loam, wet. This very deep, nearly level soil is on flood plains and on the floors of alluvial basins within the irrigated area of Imperial Valley. It formed in alluvial sediment of mixed origin. Irrigation has caused a perched water table at a depth of 36 to 60 inches, and the water can rise to a depth of 18 inches during periods of heavy irrigation. Elevation is 35 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of Holtville, Meloland, and Indio soils.

Typically, the surface layer of this Glenbar soil is pinkish gray clay loam about 13 inches thick. The underlying material is stratified, light brown clay loam, and silty clay loam to a depth of 60 inches. In places, strata of silty clay are at a depth between 10 and 60 inches; in other areas thick strata of silt loam or very fine sandy loam are at a depth of 20 to 36 inches.

Permeability is moderately slow, and available water capacity is very high. The soil is nonsaline or slightly saline. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more.

This soil is used as cropland. If irrigated, it is suited to field crops, winter vegetables, and melons (fig. 5). Alfalfa stands are difficult to maintain because of temporary anaerobic conditions after irrigation, and weak stands of alfalfa may need reseeding yearly. The soils are sticky and difficult to remove from such crops as carrots and onions. Because of the need to maintain a good salt balance without waterlogging the root zone, this soil is poorly suited to citrus. Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake.

Suitable irrigation methods are border, furrow, corrugation, and sprinkler. Border and furrow are used for most crops, but sprinkler helps to germinate such delicate, high value crops as lettuce. For surface irrigation, fields need to be leveled to a grade between 0.1 and 0.2 percent per 100 feet to avoid ponding, which causes alfalfa scald and similar plant injury during summer months. Careful irrigation management requires moderately slow movement of water through subsurface layers for good water penetration and leaching of soluble salts. Closely spaced underground drains provide leaching outlets for salinity control and maintain the water table below the root zone.

This Glenbar soil is used for homesites and urban uses despite such limitations as high clay content, high water table, and salinity. House slabs and footings need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Backfilling the base area with a compacted layer of nonplastic soil and irrigating to maintain a constant moisture level in the soil also help to reduce such stress.

Salt-tolerant plants are better suited to landscaping than most other plants.

Moderately slow permeability and a seasonal high water table are concerns for septic tank absorption fields. Tile drainage prevents or reduces these conditions, but obstacles to tile installation and poor access to outlets are common. Septic effluent needs to be filtered through several feet of soil before it can enter the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench help compensate for the moderately slow permeability. A central sewage system is better for homes on this soil than a septic tank system.

The soil is suited to such water impoundment areas as reservoirs and fish ponds. If permeable layers are exposed by pond excavation, these should be sealed during construction. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIw-3, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 37.

107—Glenbar complex. These very deep and well drained soils formed in alluvial sediment of mixed origin. They are on tilted, folded, and faulted unconsolidated stratified sediment along the edges of the valley, outside the irrigated area. Elevation is 100 feet above sea level to 230 feet below (fig. 6). Areas are narrow and linear in shape. These soils are so intricately mixed that they were not separated in mapping.

Glenbar soils are about 60 percent of this unit. Included in this unit are about 10 percent Imperial soils, 10 percent Indio soils, 5 percent each Meloland, Niland, and Holtville soils and about 5 percent Rositas and Vint soils.

The parent material of these soils is dominantly silty clay loam, but includes strata of silty clay, clay loam, sandy loam, silt loam, loamy very fine sand, and sand. Most fine and moderately fine textured strata are moderately to strongly saline. Some areas are hummocky.

Surface texture ranges from silty clay to gravelly sand, but local alluvial overwash or thin eolian deposits on some surfaces are sand, fine sand, or silt loam. Some areas have a partial desert pavement of thin flat sandstone fragments, water-worn gravel, and lime concretions.

Typically, the surface layer of the Glenbar soil is pinkish gray loam about 13 inches thick. The underlying material is light brown stratified clay loam and silty clay loam to a depth of 60 inches. In an area in T. 12 S., R. 11 E., the soil is pale yellow and light yellowish brown.

Permeability is moderately slow, and available water capacity is high to very high. The surface layer is slightly saline. Surface runoff is slow. The hazard of erosion is slight, although many areas have rills, gullies, and occasional deep arroyos from geologic erosion. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more.

These soils are used for desert recreation.

The soils have potential for irrigated farming, but development depends on an adequate supply of good quality water. Certain measures are needed: land leveling for surface irrigation; land smoothing for sprinkler irrigation; in most areas, an initial leaching for toxic salt reduction; and, in most areas, closely spaced tile drains to control salinity and to prevent the buildup of a high water table.

These soils are suited to general field crops, winter vegetables, and melons. Alfalfa stands are difficult to maintain because of temporary anaerobic conditions after irrigation. The soils are sticky and difficult to remove from such crops as carrots and onions. The soils are poorly suited to citrus because it is difficult to maintain a good salt balance without water-logging the root zone. Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake.

These Glenbar soils are moderately suited to homesites and urban areas despite such limitations as high clay content and salinity. House slabs and footings need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Backfilling the base area with a compacted layer of nonplastic soil and irrigating the area to maintain a constant moisture level help reduce stress to house slabs.

Salt-tolerant plants are better suited to landscaping than most other plants.

Limitations for septic tank absorption fields are permeability and potential development of a perched water table. Tile drains can prevent or reduce water table conditions, though obstacles to their installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench help compensate for the moderately slow permeability of the soil. The central sewage system is better for homes than a septic tank system.

This unit is suited to such water impoundment areas as reservoirs and fish ponds. If permeable layers are exposed by pond excavation, these need to be sealed during construction. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

These soils have poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIIs-6, irrigated, and capability subclass VIIIs, dryland. The Storie index rating is 52.

108—Holtville loam. This very deep, well drained, nearly level soil is on low terraces. It formed in alluvial or lacustrine sediment of mixed sources. Elevation is 30 to 200 feet.

Included with this soil in mapping are small areas of Antho soils, areas of Antho soils that have a silty clay surface layer, and areas of Imperial, Laveen, and Superstition soils.

Typically, the surface layer of this Holtville soil is about 7 inches of light brown loam over about 7 inches of pink silt loam. Underlying this is about 8 inches of reddish brown clay. Below this to a depth of 60 inches is light brown very fine sandy loam. The surface layer contains about 3 percent soft masses and concretions of lime, which is not typical of the Holtville series. In some areas the surface layer is covered with wind blown sand.

Permeability is slow in the clay layer and moderate below this layer. Available water capacity is high to very high. This soil is nonsaline or slightly saline. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

This soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Land smoothing is needed for sprinkler irrigation. For surface irrigation, land leveling is needed, but deep cuts and fills may radically change the properties of this stratified soil. Fields need to be leveled to a grade of about 0.2 percent per 100 feet to avoid ponding. Slow movement of water through the clayey layer makes careful irrigation management necessary for good penetration of water and leaching of soluble salts. Ripping and subsoiling can be effective in improving water penetration. An initial leaching for toxic salt reduction is needed in most areas. If a perched water table develops, moderately spaced tile drains help to control salinity and lower the water table.

If irrigated, this soil is suited to field and vegetable crops. It is only marginally suited to citrus because of slow permeability and poor aeration immediately after irrigation. Incorporating barnyard manure and crop residue improves the tilth of the easily compacted surface layer.

This Holtville soil is moderately suited to homesites and urban areas despite such limitations as dustiness, high clay content of some soil layers, and salinity. House slabs need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Other measures that help reduce stress to house slabs are excavating the clayey soil layers, backfilling the base area with a compacted layer of nonplastic soil, and irrigating the area to maintain a constant moisture level.

Salt-tolerant plants are better suited to landscaping than most other plants.

Septic tank absorption fields present concerns because of slow permeability in the clayey layer, and because a perched water table can develop with heavy use. Excavating absorption field trenches to a depth below the clayey layer aids permeability. Tile drainage prevents or reduces water table concerns, although obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain.

For such water impoundment areas as reservoirs and fish ponds, the moderately permeable layer below the clayey layer is a construction concern. However, where the clayey layer is thick enough, it can be excavated, stockpiled, and used to line pond excavations. The embankments of large water areas need to be protected by riprap or by such vegetation as bermudagrass to prevent wave erosion.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIs-3, irrigated, and capability subclass VIIIs, dryland. The Storie index rating is 72.

109—Holtville silty clay. This very deep, well drained stratified soil is on flood plains, terraces, and alluvial basin floors. It formed in water-laid sediment from mixed sources. It is in narrow bands in irrigated areas and is along deep drains and bluffs of the Alamo and New

Rivers. Rills and gullies are common in nonirrigated areas. Slopes are 0 to 2 percent. Elevation is 200 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of Glenbar, Imperial, Indio, and Vint soils.

Typically, the surface layer of this Holtville soil is light brown silty clay about 17 inches thick. Underlying this is light brown and very pale brown silty clay and silt loam about 18 inches thick. Below this to a depth of 60 inches is very pale brown loamy very fine sand. Some areas have a clay loam or silty clay loam surface layer over sandy strata.

Permeability is slow in the clayey layer and moderately rapid below this layer. Available water capacity is high to very high. The soil is nonsaline or slightly saline. Surface runoff is slow, and the hazard of erosion is slight. Some desert areas have rills and gullies from geologic erosion. The effective rooting depth is 60 inches or more.

This soil is used for cropland and desert recreation.

If irrigated, this unit is suited to all general field and vegetable crops of the area. It is only marginally suited to citrus because of the fine texture, slow permeability, and associated salinity hazard of the upper soil layers. Alfalfa stands are difficult to maintain because of temporary anaerobic conditions after irrigation, and some weak areas need reseeding yearly. The soil is sticky and difficult to remove from such crops as carrots and onions. Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake in the clayey upper layers. If a perched water table develops, closely spaced tile drains can control salinity and prevent the buildup of a high water table.

Suitable irrigation methods are border, furrow, corrugation, and sprinkler. Border and furrow are used for most crops, but sprinkler is commonly used to germinate such delicate, high value crops as lettuce. For surface irrigation, fields should be leveled to a grade between 0.1 and 0.2 percent per 100 feet to avoid ponding, which causes alfalfa scald and similar plant injury during summer. Land leveling with deep cuts and fills can radically change the properties of this stratified soil. Careful irrigation management is needed for good water penetration and leaching of soluble salts because water moves slowly through the surface layer. Ripping and subsoiling are effective in improving water intake.

This Holtville soil is moderately suited to homesites and urban areas despite such limitations as high clay content and salinity. House slabs need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Excavating the clayey upper soil layers, backfilling the base area with a compacted layer of nonplastic soil, and irrigating the area to maintain a constant moisture level also help reduce stress to house slabs.

Salt-tolerant plants are better suited to landscaping than most other plants.

Limitations for septic tank absorption fields under heavy use are slow permeability and a perched water table. Excavating filter field trenches to a depth below the clayey upper soil layers aids permeability. Tile drainage can prevent or reduce water table hazards, though obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain. A central sewage system is better for homes than a septic tank system.

The permeable layer underlying the clayey surface layer is a limitation for such water impoundment areas as reservoirs and fish ponds. However, the clayey upper soil layer can be excavated, stockpiled, and used to line pond excavations. Large ponds need bank protection by riprap or by such vegetation as bermudagrass to prevent wave erosion during windy periods.

Irrigated areas of this soil have a good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIs-5, irrigated, and capability subclass VIIIs, dryland. The Storie index rating is 50.

110—Holtville silty clay, wet. This very deep, stratified soil is on flood plains and alluvial basin floors. It formed in water-laid sediment from mixed sources. Irrigation has caused a perched water table at a depth of 36 to 60 inches, and the water table can rise to within 18 inches of the surface during periods of heavy irrigation. Slopes are 0 to 2 percent. Elevation is 50 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of silty Glenbar, Imperial, Indio, and Vint soils.

Typically, the surface layer of this Holtville soil is light brown silty clay about 17 inches thick. Underlying this is light brown and very pale brown silty clay and silt loam about 18 inches thick. Below this to a depth of 60 inches is very pale brown loamy very fine sand. In some areas the soil is underlain by sandy materials. In other areas the surface layer is silty clay loam or clay loam, and it is over sandy strata.

Permeability is slow in the clayey layer and moderately rapid in the underlying material. Available water capacity is high to very high. The soil is nonsaline or slightly saline. Surface runoff is slow, and the hazard of erosion is slight. The effective rooting depth is 60 inches or more.

This soil is used as cropland.

This unit is suited to all general field and vegetable crops of the area. Citrus is only marginally suitable because of the fine texture, slow permeability, and associated salinity hazard of the upper soil layers. Alfalfa stands are difficult to maintain because of temporary anaerobic conditions after irrigation, and some weak stands need reseeding yearly. The soil is sticky and difficult to remove from such crops as carrots and onions. Incorporating barnyard manure and crop residue helps maintain good tilth and improve intake in the clayey upper layers. Tile drainage is used effectively to lower the water table and provide leaching outlets for salinity control.

Suitable irrigation methods are border, furrow, corrugation, and sprinkler. Border and furrow are used for most crops, but sprinkler is commonly used to germinate such delicate, high value crops as lettuce. For surface irrigation, fields need to be leveled to a grade between 0.1 and 0.2 percent in 100 feet to avoid ponding, which causes alfalfa scald and similar plant injury during summer. Land leveling with deep cuts and fills can radically alter the properties of this stratified soil. Slow movement of water through the surface layer makes careful irrigation management necessary for good water penetration and leaching of soluble salts. Ripping and subsoiling are effective in improving intake.

This Holtville soil is used extensively for homesites and urban areas despite such limitations as high clay content, water table, and salinity. House slabs need extra strength to withstand the stresses of shrinking and swelling and to compensate for the low bearing strenth of this clayey soil. Other measures that help reduce stress to house slabs are excavating the clayey upper soil layers, backfilling the base area with a compacted layer of nonplastic soil, and irrigating the area to maintain a constant moisture level.

Salt-tolerant plants are better suited to landscaping than most other plants.

Septic tank absorption fields present concerns because of slow permeability and a seasonal high water table. Excavating filter field trenches to a depth below the clayey upper soil layers aids permeability. Tile drainage prevents or reduces the water table condition, though obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain. A central sewage system is better for homes than a septic tank system.

The permeable layer underlying the clayey surface layer presents a hazard for such water impoundment areas as reservoirs and fish ponds. However, the clayey upper soil layers can be excavated, stockpiled, and used to line pond excavations. Large ponds need bank protection by riprap or by such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIw-5, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 30.

111—Holtville-Imperial silty clay loams. These nearly level soils are on low terraces and are so intricately mixed that they are not separated in mapping. Elevation is 30 to 200 feet. Slopes are 0 to 2 percent.

The Holtville silty clay loam is about 50 percent of this unit, the Imperial silty clay loam is about 40 percent, and the rest is Antho and Niland soils.

The Holtville soil is very deep and well drained. It formed in alluvial and lacustrine sediment of mixed sources. Typically, the surface layer is light brown silty clay loam about 10 inches thick. Underlying this is reddish brown clay about 12 inches thick. Below this to a depth of 60 inches is light brown very fine sandy loam with thin strata of pink silty clay and light brown silt loam. In some areas, the surface layer contains about 3 percent soft masses and concretions, which is not typical of Holtville soils. Some areas are moderately saline.

Permeability of the Holtville soil is slow in the clayey layer and moderate in the underlying material. Available water capacity is high to very high. The soil is nonsaline or slightly saline. Surface runoff is slow, and the hazard of erosion is slight. The effective rooting depth is 60 inches or more.

The Imperial soil is very deep and moderately well drained. It formed in clayey sediment from mixed sources. Typically, the surface layer is pink silty clay loam about 12 inches thick. Underlying this to a depth of 60 inches is stratified pink heavy silty clay loam and silty clay. Efflorescences of gypsum and brown stains are common in the cracks and pores. In some areas, the profile contains about 1 percent soft masses of lime, which is not typical of Imperial soils. Some areas have a silt loam surface layer.

Permeability of the Imperial soil is slow, and available water capacity is very high. Salinity is slight. Surface runoff is slow, and the hazard of erosion is slight. The effective rooting depth is 60 inches or more.

These soils are used for desert recreation. They have been a source of clayey materials for canal lining and for improving jeep trails in sandy areas.

There is potential for irrigated farming, but development depends on an adequate supply of good quality water. If these soils are cultivated, land smoothing for sprinkler irrigation or land leveling for surface irrigation are necessary. For surface irrigation, fields need to be leveled to a grade between 0.1 and 0.2 percent per 100 feet to avoid ponding. Initial leaching can reduce soluble salts. If a perched water table develops, closely spaced tile drains can control salinity and lower the water table. Salt-tolerant crops grow best.

These soils are poorly suited to home sites and urban areas because of high clay content, salinity, and stresses of shrinking and swelling.

Salt-tolerant plants are better suited to landscaping than most other plants.

Difficulties are likely with septic tank absorportion fields because of slow permeability. A central sewage system is better for homes than a septic tank system.

These soils are suited to water impoundment areas. If permeable layers are exposed by pond excavations, they need to be sealed. Large ponds need bank protection by riprap or by such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, these soils can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIs-6, irrigated, and capability subclass VIIIs, dryland. The Storie index rating is 59.

112—Imperial silty clay. This very deep, moderately well drained soil is on flood plains and in basins and lakebeds. It formed in clayey sediment from mixed sources. Elevations are 50 feet above sea level to 230 feet below. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Niland, Meloland, and Holtville soils.

Typically, the surface layer of this Imperial soil is pinkish gray and light brown silty clay to a depth of 60 inches or more. Efflorescences of gypsum and brown stains are common in the cracks and pores. In some places the surface layer has very thin layers of silt or very fine sand. Flagstones or gravel lie on the soil surface.

Permeability is slow, and available water capacity is very high. Salinity is moderate. Surface runoff is slow to ponded, and the hazard of erosion is slight. Because of geologic erosion, rills and gullies are common in desert areas. The effective rooting depth is 60 inches or more.

This soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Land smoothing for sprinkler irrigation or land leveling for surface irrigation are required if this soil is cultivated. Initial leaching can reduce soluble salts. Closely spaced tile drains are needed in most areas to control salinity and to prevent the buildup of a high water table. Salt-tolerant crops grow best. When irrigated, this soil has limitations similar to those of Imperial silty clay, wet.

This Imperial soil is poorly suited to homesites and urban areas because of high clay content, salinity, low bearing strength, and stresses of shrinking and swelling. Playa areas lack surface drainage.

Salt-tolerant plants are better suited to landscaping than most other plants.

Difficulties are likely with septic tank absorption fields because of slow permeability, therefore a central sewage system is better for homes.

This soil is suited to water impoundment areas. Permeable layers exposed by pond excavations need to be sealed. Large ponds need bank protection by riprap or by such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIw-6, and capability subclass VIIIs, dryland. The Storie index rating is 36.

113—Imperial silty clay, saline. This very deep soil is on flood plains and in basins and lakebeds. It formed in clayey sediment from mixed sources. Irrigation and seepage has caused a perched water table at a depth of 36 to 60 inches, and the water table may rise to a depth of 18 inches during periods of heavy irrigation. Elevation is 30 feet above sea level to 230 feet below. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Imperial silty clay, wet; Niland gravelly sand, wet; and Meloland very fine sandy loam, wet.

Typically, the Imperial silty clay, saline, is pinkish gray and light brown silty clay to a depth of 60 inches. Efflorescences of gypsum and brown stains are common in the cracks and pores.

Permeability is slow, and available water capacity is very high. The soil is moderately to strongly saline. Surface runoff is slow, and the hazard of erosion is slight. The effective rooting depth is 60 inches or more.

Most areas of this soil are idle. Small inclusions in other cultivated soils appear as bare spots or areas of stunted plant growth. Areas are mainly used as wetland wildlife habitat.

This soil has poor potential for cropland. It is strongly saline and extremely difficult to reclaim because present technology is slow and expensive. Reclamation requires closely spaced tile drains and long periods of leaching. Even then, this soil has to be handled with special care to prevent resalinization. After reclamation, such salt-tolerant crops as bermudagrass, barley, cotton, and sugar beets grow best.

This Imperial soil is poorly suited to homesites and urban areas because of high clay content, water table, and salinity. House slabs and footings need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Backfilling the base area with a compacted layer of nonplastic soil and irrigating the area to maintain a constant moisture level also helps reduce stress to house slabs.

Plants that are very salt-tolerant are better suited to landscaping than most other plants.

Limitations for septic tank absorption fields are slow permeability and a high water table. Tile drainage prevents or reduces water table conditions, though obstacles to tile installation and poor access to outlets are common in the built-up areas. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench can help compensate for the slow permeability of the soil. A central sewage system is better for homes than a septic tank system.

This soil is suited to water impoundment areas. Large ponds need bank protection of riprap or such salt-tolerant vegetation as saltgrass to prevent wave erosion.

This soil is used for wetland wildlife habitat. To encourage added wildlife populations, the soil can be ponded and managed for ducks, geese, and other wetland wildlife. Such salt-tolerant plants as alkali bulrush are best suited as food in these impoundment areas.

This map unit is in capability unit VIw-6, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 3.

114—Imperial silty clay, wet. This very deep soil is on flood plains and in basins and lakebeds. It formed in clayey sediment from mixed sources. Irrigation has caused a perched water table at a depth of 36 to 60 inches which can rise to a depth of 18 inches during periods of heavy irrigation. Elevation is 50 feet above sea level to 230 feet below. Slopes are 0 to 2 percent.

Included with this soil in mapping are small areas of Glenbar soils that have a silty clay surface layer and significant strata of silty clay at a depth between 40 and 60 inches. A few areas are Meloland very fine sandy loam, Niland gravelly sand, and Holtville silty clay.

About 40 acres of this unit near Red Hill have been diked off for evaporation ponds (salt ponds) for steam-well effluent.

Typically, the Imperial silty clay, wet, is pinkish gray and light brown silty clay to a depth of 60 inches or more. Efflorescences of gypsum and brown stains are common in the cracks and pores. In some places the surface layer is silty clay loam or clay loam.

Permeability is slow, and available water capacity is very high. The soil is slightly saline. Surface runoff is slow, and the hazard of erosion is slight. The effective rooting depth is 60 inches or more.

This soil is used for general field crops, and to a lesser extent, for winter vegetables and melons. Where salinity levels are low, it is well adapted to these crops. Alfalfa stands are difficult to maintain because of temporary anaerobic conditions after irrigation and heaving of the taproot from the soil's shrink-swell action. Weak stands of alfalfa may need reseeding yearly. The soil is sticky and difficult to remove from such crops as carrots and onions. Salt-tolerant crops grow best (fig. 7). Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake.

Suitable irrigation methods are border, furrow, corrugation, and sprinkler. Border and furrow are used for most crops, but sprinkler is commonly used to germinate such delicate, high value crops as lettuce. For surface irrigation, fields need to be leveled to grades between 0.1 and 0.2 percent per 100 feet to avoid ponding, which causes alfalfa scald and similar plant injury during summer. Slow movement of water through subsurface layers inhibits good water penetration and leaching of soluble salts. Closely spaced underground drains provide leaching outlets for salinity control and prevent a high water table.

This Imperial soil is used extensively for homesites and urban areas despite such limitations as high clay content, water table, and salinity. House slabs need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Backfilling the base area with a compacted layer of nonplastic soil and irrigating to maintain a constant moisture level also help reduce stress to house slabs.

Salt-tolerant plants are better suited to landscaping than most other plants.

Limitations for septic tank absorption fields are slow permeability and a seasonally high water table, though obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench helps to compensate for the slow permeability of the soil. A central sewage system is better for homes than a septic tank system.

This soil is suited to water impoundment areas. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Desert areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIw-6, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 22.

115—Imperial-Glenbar silty clay loams, wet, 0 to 2 percent slopes. These nearly level soils are on flood plains and lakebeds within the irrigated areas of Imperial Valley. Elevation is 35 feet above sea level to 230 feet below.

The Imperial and Glenbar soils are intermingled in an unpredictable pattern, and this map unit averages about 40 percent of each soil. Holtville soils, with slowly permeable layers below a depth of 40 inches, and Meloland soils, with a fine textured surface layer, make up the rest of the unit.

About 95 acres of this unit near Red Hill has been diked off for evaporation ponds (salt ponds) for steamwell effluent.

The Imperial soil is very deep. It formed in clayey sediment from mixed sources. Irrigation has caused a perched water table commonly at a depth of 36 to 60 inches, but which can rise to a depth of 18 inches during periods of heavy irrigation. Typically, the surface layer is pinkish gray silty clay loam about 12 inches thick. The underlying material is pinkish gray and light brown silty clay to a depth of 60 inches. Efflorescences of gypsum and brown stains are common in the cracks and pores.

Permeability of this Imperial soil is slow, and available water capacity is very high. The soil is slightly saline. Surface runoff is slow, and the hazard of erosion is slight. The effective rooting depth is 60 inches or more.

The Glenbar soil is very deep. It formed in alluvium of mixed origin. Irrigation has caused a perched water table commonly at a depth of 36 to 60 inches, but which can rise to a depth of 18 inches during periods of heavy irrigation. Typically, the surface layer is pinkish gray silty clay loam about 13 inches thick. The underlying material is stratified light brown clay loam and silty clay loam, with thin lenses of silty clay and sandy clay loam to a depth of 60 inches.

Permeability of this Glenbar soil is moderately slow, and available water capacity is very high. The soil is nonsaline to slightly saline. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more.

These soils are used for cropland and urban purposes.

If irrigated, the soils are suited to general field crops, and to a lesser extent, to winter vegetables and melons. These crops grow well. Alfalfa stands are difficult to maintain because of temporary anaerobic conditions after irrigation and heaving of the taproot from the soil's shrink-swell action. Weak stands of alfalfa may need reseeding yearly. The soils are sticky and difficult to remove from such crops as carrots and onions. Adequate tile drainage and careful irrigation water management help to keep a favorable salt balance. Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake.

Suitable irrigation methods are border, furrow, corrugation, and sprinkler. Border and furrow are used for most crops, but sprinkler is commonly used to germinate such delicate, high value crops as lettuce. For surface irrigation, fields need to be leveled to grades between 0.1 and 0.2 percent per 100 feet to avoid ponding, which causes alfalfa scald and similar plant injury during summer. Slow movement of water through subsurface layers inhibits good water penetration and leaching of soluble salts. Closely spaced underground drains provide leaching outlets for salinity control and prevent a high water table.

These soils are used extensively for homesites and urban areas despite such limitations as high clay content, water table, and salinity. House slabs and footings need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Backfilling the base area with a compacted layer of nonplastic soil and irrigating to maintain a constant moisture level also help reduce stress to house slabs.

Salt-tolerant plants are better suited to landscaping than most other plants.

Difficulties are likely with septic tank absorption fields because of permeability and a seasonal high water table. Tile drainage prevents or reduces water table concerns, though obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench helps to compensate for the moderately slow permeability of the soils. A central sewage system is better for homes than a septic tank system.

These soils are suited to water impoundment areas. If permeable layers are exposed by pond excavation, they need to be sealed. Large ponds need bank protection by riprap or by such vegetation as bermudagrass to prevent wave erosion.

Irrigation areas of these soils have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, these soils can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIw-6, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 34.

116—Imperial-Glenbar silty clay loams, 2 to 5 percent slopes. These gently sloping soils are on low escarpments within flood plains and alluvial basins, where they lie in an unpredictable pattern. Rills and gullies from geologic erosion are common. Elevation is 200 feet above sea level to 230 feet below.

The Imperial and Glenbar soils each average about 40 percent of the unit; the rest is Holtville and Meloland soils.

The Imperial soil is very deep and moderately well drained. It formed in clayey sediment from mixed sources. Typically, the surface layer is pink silty clay loam about 13 inches thick. The underlying material is pinkish gray and light brown silty clay to a depth of 60 inches. Efflorescences of gypsum and brown stains are common in the cracks and pores.

Permeability of this Imperial soil is slow, and the available water capacity is very high. The soil is slightly saline. Surface runoff is medium, and the hazard of erosion is moderate. The effective rooting depth is 60 inches or more.

The Glenbar soil is very deep and well drained. It formed in alluvial sediment of mixed origin. Typically, the surface layer is pinkish gray silty clay loam about 13 inches thick. The underlying material is light brown stratified clay loam and silty clay loam to a depth of 60 inches.

Permeability of this Glenbar soil is moderately slow, and available water capacity is very high. Surface runoff is medium, and the hazard of erosion is moderate. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more. Some areas are moderately saline to strongly saline.

Most of this unit is used for desert recreation, though there are small areas of corrals and feedlots.

These soils have potential for irrigated farming, but development depends on an adequate supply of good quality water. Land smoothing is needed for sprinkler irrigation. Major land leveling with deep cuts and fills makes these soils suitable for surface irrigation (fig. 8). Land leveling has little effect on the soil properties. An initial leaching period can reduce toxic salts before cropping. Closely spaced tile drains provide leaching outlets and prevent build up of a high water table. Since these soils are leveled in benches, there is special hazard of erosion from irrigation water escaping at the bench edges.

If irrigated, these soils are suited to field crops, and to a lesser extent, to winter vegetables and melons. Where salinity levels are low, these crops grow well. Alfalfa stands are difficult to maintain because of temporary anaerobic conditions after irrigation and heaving of the taproot from the soil's shrink-swell action. Weak areas of alfalfa may need reseeding yearly. The soils are sticky and difficult to remove from such crops as carrots and onions. Salt-tolerant crops grow best. Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake.

These soils are poorly suited to homesites and urban areas because of high clay content and salinity. House slabs and footings need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Backfilling the base area with a compacted layer of nonplastic soil and irrigating the area to maintain a constant moisture level also help reduce stress to house slabs.

Salt-tolerant plants are better suited for landscaping than most other plants.

Limitations for septic tank absorption fields are permeability and possible development of a high water table. Tile drainage prevents or reduces water table conditions, though obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench help compensate for the permeability of the soils. A central sewage system is better for homes than a septic tank system.

These soils are suited for water impoundment areas, but slopes limit the size and shape of ponds.

These soils have poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIIe-6, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 38.

117—Indio loam. This very deep, well drained, nearly level soil is on flood plains and basin floors. It formed in alluvial and eolian sediments of mixed origin. Elevation is 35 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of soils that have a silt loam or very fine sandy loam surface layer overlying loamy fine sand or fine sand at a depth of 18 to 36 inches, areas of Meloland soils that have a medium textured layer at a depth of 40 to 60 inches, areas of Glenbar soils, and areas of Vint soils.

In the lower Borrego Valley this unit adjoins a soil mapped in San Diego County, Indio silt loam, saline, 0 to 2 percent slopes, which is a minor inclusion. Also, this unit adjoins Rositas fine sand, hummocky, 5 to 9 percent slopes, and extends slightly into the San Diego County map unit.

Typically, the surface layer of this Indio soil is pinkish gray loam about 12 inches thick. The underlying material is stratified very pale brown and pink light silt loam and loamy very fine sand to a depth of 60 inches or more. The layers below the surface layer have brown stains on the faces of cracks to a depth of about 44 inches. In some places the surface layer is silt loam, fine sandy loam, or loamy fine sand, or there is a layer of silty clay at a depth of 40 to 60 inches.

Permeability is moderate, and available water capacity is high to very high. Surface runoff is slow, and the hazard of erosion is slight. There is a moderate hazard of soil blowing and abrasion to young plants. The effective rooting depth is 60 inches or more.

This soil is used for all irrigated crops of this area.

If irrigated, the soil is well suited to high value crops, including winter vegetables and citrus. Salinity can be controlled through ordinary irrigation management. Desert areas require adequate, good quality irrigation water for development. Before irrigaiton, the soil needs land leveling or smoothing and initial leaching in saline areas. If a perched water table develops, moderately widely spaced tile drains can control salinity and lower the water table. Indio loam is especially susceptible to piping and gully erosion. Erosion occurs when irrigation water enters the drainage channel through rodent burrows or a drop spillway fails. Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake on this easily compacted soil.

Suitable irrigation methods are border, furrow, corrugation, and sprinkler. Border and furrow are used for most crops, but sprinkler is commonly used to germinate such delicate, high value crops as lettuce. For efficient surface irrigation, fields need to be leveled to a grade of about 0.2 percent in 100 feet with runs not longer than 1/4 mile.

This Indio soil is well suited to homesites and urban areas, though limited by dustiness.

Most climatically adapted plants are suitable for landscaping.

Septic tank absorption fields can function well if designed to compensate for the soil's moderate permeability.

Ponds and reservoirs will develop seepage problems unless sealed or lined.

Irrigated areas have good potential for cottontail rabbit, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, the soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability class I, irrigated, and capability subclass VIIIc, dryland. The Storie index rating is 100.

118—Indio loam, wet. This very deep, nearly level soil is on flood plains and basin floors. It formed in alluvium and eolian sediment of mixed origin. Elevation is 35 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of Vint soils that have a medium textured surface layer and areas of soils that have a silt loam or very fine sandy loam surface layer overlying loamy fine sand or fine sand at a depth of 18 to 36 inches. Also included are areas of Meloland, Holtville, Glenbar, and Vint soils.

In this Indio soil, irrigation has caused a perched water table at a depth of 36 to 60 inches which can rise to a depth of 18 inches during periods of heavy irrigation.

Typically, the surface layer of this Indio soil is a pinkish gray loam about 12 inches thick. The underlying material is stratified very pale brown and pink light silt loam and loamy very fine sand to a depth of 60 inches or more. The layers below the surface layer have brown stains on the crack faces to a depth of 44 inches. In some places the surface layer is silt loam, very fine sandy loam, or fine sandy loam, or there is silty clay at a depth between 40 and 60 inches.

Permeability is moderate, and available water capacity is high to very high. Surface runoff is slow, and the hazard of erosion is slight. There is a moderate hazard of soil blowing. Effective rooting depth is 60 inches or more.

This soil is used for all irrigated crops of the area.

When properly managed, this soil is well suited to high value crops, including winter vegetables and citrus. Moderately spaced tile drains are needed to control the water table and provide outlets for leaching toxic salts. Salinity can be controlled through ordinary irrigation management. This soil is susceptible to piping and gully erosion. Erosion occurs when irrigation water enters the drainage channel through rodent burrows, or a drop spillway fails. Incorporating barnyard manure and crop residue helps to maintain good tilth and improve water intake on this easily compacted soil.

Suitable irrigation methods are border, furrow, corrugation, and sprinkler. Border and furrow are used for most crops, but sprinkler helps to germinate such delicate, high value crops as lettuce. For efficient surface irrigation, fields need to be leveled to a grade of about 0.2 percent per 100 feet with runs no longer than 1/4 mile.

This Indio soil is fairly well suited to homesites and urban areas, although limited by dustiness and a high water table. Revegetating disturbed areas around construction sites helps to control soil blowing.

Most climatically adapted plants are suitable for landscaping, if the water table does not rise too high.

Limitations for septic tank absorption fields are permeability and a seasonal high water table. Permeability difficulties can usually be overcome by extra length of filter field lines and sandy backfill in the trenches. Tile drainage prevents or reduces water table concerns, though obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain. A central sewage system is better for homes than a septic tank system.

Ponds or reservoirs develop seepage problems unless sealed or lined.

Irrigated areas have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, the soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capablity unit IIw-1, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 60.

119—Indio-Vint complex. These nearly level soils are on flood plains and alluvial basin floors and are so intricately mixed that they were not separated on the soil map. Elevation is 200 feet above sea level to 230 feet below.

This unit averages about 35 percent Indio loam and 30 percent Vint loamy fine sand. The remaining 35 percent is Rositas, Meloland, and Holtville soils; soils that are highly stratified with sand to silt loam textures; narrow areas with slopes of 2 to 5 percent; and areas that have hummocky or dune topography. In an area on West Mesa, near California Highway 98, are about 200 acres that have numerous flat stones on the surface or outcrops of soft sandstone.

The Indio soil is very deep and well drained. It formed in alluvial and eolian sediments of mixed origin. Typically, the surface layer is pinkish gray loam about 12 inches thick. The underlying material is stratified very pale brown and pink light silt loam and loamy very fine sand to a depth of 60 inches or more. The layers below the surface layer have brown stains on the faces of cracks to a depth of about 44 inches. Some areas are saline.

Permeability of the Indio soil is moderate, and available water capacity is high to very high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more.

The Vint soil is very deep and well drained. It formed in alluvial and eolian sediments from diverse sources. Typically, the soil is stratified light brown and pink loamy fine sand to a depth of 60 inches. Several thin lenses of silt loam are at a depth between 10 to 40 inches.

Permeability of the Vint soil is moderately rapid, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The effective rooting depth is 60 inches or more.

Most areas of these soils are desert or idle land and are used for desert recreation and desert wildlife habitat. Small areas are feedlots or stockyards.

These soils have potential for irrigated farming, but development depends on an adequate supply of good quality water. If cultivated, the soils need land smoothing for sprinkler irrigation or land leveling for surface irrigation. For efficient surface irrigation, fields need to be leveled to a grade between 0.2 to 0.25 percent per 100 feet, with runs of about 400 feet. Initial leaching is needed in some areas to reduce soluble salts. If a perched water table develops, moderately spaced tile drains can control salinity and lower the water table. Proper use of crop residue and minimum tillage helps control soil blowing.

These soils are suited to all climatically adapted crops including citrus. The soils wash easily from carrots and onions. Incorporating barnyard manure and plant residue helps maintain tilth and permeability of the Indio soil and improves the nutrient- and water-holding capacities of the Vint soil.

This unit is well suited to homesites and urban areas, although dustiness and sandy soil materials affect use. Revegetating disturbed areas around construction sites helps to control soil blowing and dustiness around homesites.

Most climatically adapted plants are suitable for landscaping.

Septic tank absorption fields can function well. If a perched water table develops with heavy use of absorption fields, moderately spaced tile drains can reduce the condition. However, obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

These soils are too permeable for water impoundment construction, so ponds and reservoirs need an impervious lining to prevent seepage.

There is poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIs-1, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 90.

120—Laveen loam. This very deep, well drained, nearly level to gently sloping soil is on erosional remnants of old alluvial terraces and on old alluvial fans. It formed in alluvial material from mixed sources. Elevation is 50 to 350 feet.

Included with this soil in mapping are small areas of Antho, Rositas, Superstition, and Vint soils and small areas of Laveen or similar soils that have slopes greater than 2 percent.

Typically, the surface layer of this Laveen soil is pink, loamy very fine sand about 2 inches thick. Underlying this is reddish yellow and light yellowish brown loam, and very fine sandy loam about 26 inches thick. Below this is very pale brown very fine sandy loam to a depth of 60 inches. Soil layers at a depth between 2 and 28 inches contain more than 5 percent segregated lime. In some areas these soils have strata that have more than 15 percent gravel. Most areas are covered by a well developed desert pavement with a desert varnish (fig. 9).

Permeability is moderate, and available water capacity is high to very high. Surface runoff is medium, and the hazard of erosion is slight. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

There is potential for irrigated farming, but development depends on an adequate supply of good quality water. Sprinkler or drip irrigation systems are the most efficient because of the natural slope of 0.5 to 2.0 percent, and the coarse surface textures. Efficient surface irrigation can employ land leveling with large cuts and fills, or cross slope irrigation. Where surface irrigation is used, fields need to be leveled to a grade of about 0.2 percent per 100 feet with runs not longer than 1/4 mile. Initial leaching is required in some areas to reduce soluble salts. If a perched water table develops, moderately spaced tile drains help to control salinity and reduce the high water table.

This unit is suited to all general field and vegetable crops of the area, and, after leaching, may be suitable for citrus. Proper use of crop residue and minimum tillage can help to control soil blowing.

This Laveen soil is well suited to homesites and urban areas, though the sandy surface layer and salinity affect use. Revegetating disturbed areas around construction sites helps to control soil blowing.

Salt tolerant plants are better suited for landscaping than most other plants.

Septic tank absorption fields can function well. Extra length of septic tank absorption lines and sandy backfill of the trenches can help compensate for the soil's moderate permeability. If a perched water table develops from heavy use of absorption fields, moderately spaced tile drains can reduce the condition. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

Ponds and reservoirs can develop seepage problems unless sealed or lined.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIe-1, irrigated, and VIIIe, dryland. The Storie index rating is 76.

121—Meloland fine sand. This very deep, well drained, nearly level soil is on flood plains and alluvial basin floors. It formed in alluvial or eolian sediments of mixed origin. It lies on the valley edges outside the irrigated area in irregular bodies ranging from more than 40 acres in size to less than an acre. Elevation is 150 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of Niland, Glenbar, Meloland, and Rositas soils.

Typically, the surface layer of this Meloland soil is reddish yellow fine sand about 12 inches thick. Underlying this is stratified very pale brown loamy very fine sand and silt loam about 14 inches thick. Below this is pink silty clay to a depth of 60 inches. In some areas, the silty clay layers are moderately saline to strongly saline and have gypsum efflorescences in the cracks. Some areas have a partial desert pavement of soft, flat sandstone fragments, waterworn gravel, and lime concretions.

Permeability is slow, and available water capacity is high to very high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The soil is nonsaline or slightly saline in the surface layer, but is moderately saline below a depth of about 2 feet. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

There is potential for irrigated farming, but development depends on an adequate supply of good quality water. Land smoothing for sprinkler irrigation or land leveling for surface irrigation is required if the soil is cultivated. Sprinkler or drip irrigation can apply water more efficiently to the sandy surface layer than other methods. Land leveling with deep cuts and fills can radically change this stratified soil. If surface irrigation is used, fields need to be leveled to a grade between 0.2 and 0.3 percent per 100 feet, have runs of about 400 feet, and have high heads of water. An initial leaching is required in most places to reduce soluble salts. If a perched water table develops, closely spaced tile drains help to control salinity and lower the water table. Proper crop residue use and minimum tillage help to control soil blowing.

If irrigated, this soil has potential for all general field and vegetable crops of the area, though the slow permeability of the lower stratum makes it poorly suited to citrus. This soil is preferred for carrots and onions because the friable surface soil washes easily from the roots.

This Meloland soil is moderately suited to homesites and urban areas, though sandy surface layers and salinity affect its use. House slab and footing designs need to compensate for the soil's low bearing strength. Revegetating disturbed areas around construction sites help to control soil blowing.

Salt-tolerant plants are better suited for landscaping than most other plants.

Limitation for septic tank absorption fields is slow permeability of the underlying clayey layers. A high water table can develop rapidly from heavy use of absorption fields. Tile drainage prevents or reduces such a condition, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench helps to compensate for the slow permeability of the substrata. A central sewage system is better for homes than a septic tank system.

In water impoundments such as reservoirs and fish ponds, excessive seepage can be avoided by mixing and compacting the sandy surface layer and the clayey substratum. Large ponds need bank protection by riprap or by such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIs-3, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 47.

122—Meloland very fine sandy loam, wet. This very deep, nearly level soil is on flood plains and alluvial basin floors. It formed in alluvial or eolian sediments of mixed origin. Irrigation has caused a perched water table at a depth of 24 to 36 inches. Elevation is 35 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of Imperial, Indio, Holtville, Glenbar, and Vint soils. Also included are some stratified soils that have a layer of silt loam overlying silty clay at a depth of 36 inches or less and about 350 acres of strongly saline Meloland soils along Fish Creek Wash that are affected by seepage. About 10 acres of this unit near Red Hill have been diked off for evaporation ponds (salt ponds) for steam-well effluent.

Typically, the surface layer of this Meloland soil is light brown very fine sandy loam about 12 inches thick. The underlying material is stratified, very pale brown loamy fine sand and silt loam about 14 inches thick. Below this is pink silty clay to a depth of 71 inches that has gypsum efflorescences in the cracks. In some places, the surface layer is silt loam, loam, or fine sandy loam.

Permeability is slow, and available water capacity is high to very high. Surface runoff is slow, and the hazard of erosion is slight. There is a moderate hazard of soil blowing and abrasion to young plants. The soil is nonsaline or slightly saline in the surface layer but is moderately saline below a depth of about 2 feet. The effective rooting depth is 60 inches or more.

This soil is used as cropland.

When properly managed, this unit is suited to all general field and vegetable crops of the area (fig. 10). The slow permeability of the clayey underlying material makes it poorly suited to citrus. This soil is preferred for carrots and onions because the friable surface soil washes easily from the roots.

Suitable irrigation methods are border, furrow, and sprinkler. Sprinkler is commonly used to germinate such vegetable crops as carrots, lettuce, and onions. For efficient surface irrigation, fields need to be leveled to a grade of 0.2 percent per 100 feet with runs no longer than 1/4 mile. Careful leveling to grade prevents ponding, which causes alfalfa scald and similar plant injury during summer.

Deep leaching of soluble salts is difficult because of the slow movement of water through the clayey underlying material. Moderately close spaced tile drains can provide leaching outlets to help control salinity and prevent the buildup of a high water table.

This Meloland soil is used for homesites and urban areas despite such limitations as slow permeability of the underlying material, high water table, and salinity. Designs of house slabs and footings need to compensate for the low bearing strength of this soil.

Salt-tolerant plants are better suited to landscaping than most other plants.

Limitations for septic tank absorption fields are slow permeability of the subsurface layer and a seasonal high water table. Tile drainage prevents or reduces the water table condition, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines and sandy backfill of the trench help compensate for the slow permeability of the underlying material. A central sewage system is better for homes than a septic tank system.

In water impoundments such as reservoirs and fish ponds, excessive seepage can be avoided by mixing and compacting the sandy surface layer and the clayey underlying material. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIw-3, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 43.

123—Meloland and Holtville loams, wet. These nearly level soils formed on flood plains and alluvial basin floors. The soil bodies are irregular in shape, and consist of one or both of the major soils in an unpredictable pattern. Elevation is 35 feet above sea level to 230 feet below.

Included with these soils in mapping are small areas of Glenbar, Imperial, Indio, Rositas, and Vint soils.

The Meloland loam is very deep. It formed in alluvial or eolian sediment of mixed origin. Irrigation has caused a perched water table at a depth of 24 to 36 inches that can rise to a depth of 18 inches during periods of heavy irrigation. Typically, the surface layer is light brown loam about 12 inches thick. The underlying material is stratified, very pale brown loamy fine sand and silt loam about 14 inches thick. Below this is pink silty clay to a depth of 38 inches that has gypsum efflorescences in the cracks. The deeper layers are stratified silt loam, very fine sandy loam, and loamy fine sand to a depth of 60 inches. Some areas are strongly saline.

Permeability of the Meloland soil is slow, and available water capacity is high to very high. Surface runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is moderate. The soil is nonsaline or slightly saline in the surface layer, but is moderately saline below a depth of about 2 feet. The effective rooting depth is 60 inches or more.

The Holtville loam is very deep and stratified. It formed in water-laid sediment from mixed sources. Irrigation has caused a perched water table at a depth of 36 to 60 inches that can rise to a depth of 18 inches during periods of heavy irrigation. Typically, the surface layer is light brown loam about 12 inches thick. The underlying material is light brown silty clay about 12 inches thick. Below this is very pale brown silt loam about 12 inches thick and very pale brown loamy very fine sand to a depth of 60 inches.

Permeability of the Holtville soil is slow, and available water capacity is high to very high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate. The soil is nonsaline or slightly saline throughout. The effective rooting depth is 60 inches or more.

Most areas of soils in this map unit are cropland. When properly managed, this unit is suited to all general field and vegetable crops of the area. It is poorly suited to all citrus because of the slow permeability of the subsurface material. These soils are preferred for carrots and onions because the friable surface soil washes easily from the roots.

Suitable irrigation methods are border, furrow, and sprinkler. Sprinkler is commonly used to germinate such vegetable crops as carrots, lettuce, and onions. For efficient surface irrigation, fields need to be leveled to a grade of 0.2 percent per 100 feet with runs no longer than 1/4 mile.

Careful leveling to grade prevents ponding, which causes alfalfa scald and similar plant injury during summer. Good irrigation management requires slow movement of water through subsurface layers for deep leaching of soluble salts. Deep tillage can improve water movement through these stratified soils. Moderately widely spaced tile drains can provide leaching outlets to control salinity and prevent the buildup of a high water table.

These soils are used for homesites and urban areas despite such limitations as clayey subsurface layer, water table, and salinity. House slabs need extra strength to withstand the stresses of shrinking and swelling and to compensate for the soil's low bearing strength. Excavating the clayey soil layers, backfilling the base area with a compacted layer of nonplastic soil, and irrigating the area to maintain a constant moisture level also help reduce stress to house slabs.

Salt-tolerant plants are better suited for landscaping than most other plants.

Limitations for septic tank absorption fields are slow permeability and a seasonal high water table. Permeability conditions can usually be overcome by excavating filter field trenches to a depth below the clayey material. Tile drainage prevents or reduces water table limitations, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. A central sewage system is better for homes than a septic tank system.

The stratification of these soils is a consideration in construction of such water impoundment areas as reservoirs and fish ponds. However, where the clayey layers are thick enough, they can be excavated, stockpiled, and used to line pond excavations. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of these soils have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, these soils can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIw-3, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 43.

124—Niland gravelly sand. This very deep, moderately well drained, nearly level soil is on the edges of flood plains and alluvial basins. It formed in alluvial materials of mixed origin. In some areas there are many minor ridges parallel to the main beach line. Elevation is 35 feet above sea level to 230 feet below.

Included with this soil in mapping are small areas of Imperial soils that have a sandy surface layer, Meloland soils that have a sandy loam surface layer, and Carsitas soils that have silty clay at a depth of 40 to 60 inches. Also included are areas of Indio-Vint complex, Rositas fine sand, and undifferentiated wet areas around springs and seeps.

Typically, this Niland soil to a depth of about 23 inches is stratified, very pale brown gravelly sand. Below this is pale brown silty clay to a depth of 60 inches. Most areas have a partial surface cover of gravel or soft flat sandstones and flagstones. Small areas have short slopes of 2 to 5 percent.

Permeability is slow, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The soil is nonsaline or slightly saline to a depth of 2 feet but can be moderately saline below this. The effective rooting depth is 60 inches or more.

Most areas of this soil are idle or desert.

The soil is used for winter production of tomatoes and squash. Good air drainage on this unit gives an appreciably longer frost-free season for these crops than in the rest of the Imperial Valley.

This soil is suited to field and vegetable crops if it is irrigated. Shallow-rooted, salt-tolerant crops grow best because of potential anaerobic conditions and a perched water table at the top of the saline substratum following irrigation. Alfalfa stands are difficult to maintain because of the slowly permeable substratum and a potential perched water table.

This soil has potential for irrigated farming. Almost all of this unit is higher than the East Highline Canal where irrigation water can be obtained. Sprinkler or drip irrigation systems are the most efficient methods because of the natural slope of 0.5 to 2.0 percent and the coarse surface texture. Efficient surface irrigation requires land leveling, with large cuts and fills, or cross slope irrigation. Surface irrigation requires a grade of about 0.3 percent per 100 feet, runs of about 250 feet, and large heads of water.

Land leveling tends to concentrate the sandy surface materials on the downhill side of the fields and expose silty clay materials on the uphill side, giving greatly different water intake rates on different portions of the same field. The silty clay layers are saline in most areas and commonly need considerable leaching before exposed areas are productive. Closely spaced tile drains provide leaching outlets to control salinity and to prevent the buildup of a high water table. Most areas of this unit are dissected by deep drainageways carved by runoff from upslope alluvial fans, which add to the difficulty of leveling large fields. If these areas are to be developed for irrigation, storm dikes and storm drains are needed to divert and channel upslope runoff.

This Niland soil is suited to homesites and urban areas despite such limitations as a sandy surface, clayey substratum, and salinity. House slabs and footings need extra strength to withstand the stresses of shrinking and swelling. Irrigating areas to maintain a constant moisture level helps to reduce stress from the shrinking and swelling of the clayey layer.

Salt-tolerant plants are better for landscaping than most other plants.

Limitations for septic tank absorption fields are slow permeability of the clayey stratum and the development of a perched water table. Tile drainage prevents or reduces such conditions, though obstacles to tile installation and poor access to outlets are common in the built-up areas. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines helps to compensate for the slow permeability of the clayey layers. A central sewage system is better for homes than septic tank systems.

In water impoundments such as reservoirs and fish ponds, escessive seepage can be avoided by mixing and compacting the sandy surface layer with the clayey substratum. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IVs-3, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 21.

125—Niland gravelly sand, wet. This very deep, nearly level soil is on the edges of flood plains and alluvial basins. It formed in alluvial materials of diverse sources. Elevation is 35 feet above sea level to 230 feet below.

Included with this soil in mapping are areas of Imperial soils that have a surface layer of sand or gravelly sand and areas of Carsitas, Imperial, and Meloland soils. Also included are about 250 acres of soil affected by seepage from the Coachella Canal; this soil differs from the Niland gravelly sand, wet, by having lime segregations at a depth of less than 36 inches.

Irrigation has caused a perched water table at a depth of 24 to 36 inches that can rise to a depth of 18 inches during periods of heavy irrigation.

Typically, the surface layer of this Niland soil is very pale brown, stratified gravelly sand about 23 inches thick. Below this is pale brown silty clay to a depth of 60 inches.

Permeability is slow, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. There is a high hazard of soil blowing and abrasion to young plants. The soil is nonsaline or slightly saline to a depth of about 2 feet, but may be moderately saline below this depth. The effective rooting depth is 60 inches or more.

This unit is used extensively for winter production of tomatoes and squash. Good air drainage gives an appreciably longer frost-free season for these crops than in most areas of the Imperial Valley. Some areas are used for irrigated pasture.

This soil is suited to field crops, if it is irrigated. Shallow-rooted, salt-tolerant crops grow best because of anaerobic conditions and a perched water table at the top of the saline clayey layer. Alfalfa stands are difficult to maintain because of the slowly permeable clayey layer and a perched water table.

Suitable irrigation methods are border, furrow, sprinkler, and drip. Land leveling, with large cuts and fills, or cross slope irrigation is needed for efficient surface irrigation. The average natural slopes are 0.5 to 1.5 percent on most of this unit. Where surface irrigation is used, a grade of 0.3 percent per 100 feet, runs of about 250 feet, and large heads of water are most efficient.

Land leveling tends to concentrate the sandy surface materials on the lower end of the fields and expose silty clay materials on the higher end, giving greatly different water intake rates on different portions of the same field.

The silty clay layers are saline in many areas and commonly need considerable leaching before exposed areas are productive. Closely spaced tile drains provide leaching outlets to control salinity and to lower the water table.

Most areas of this unit are dissected by deep drainageways carved by runoff from upslope alluvial fans, which adds to the difficulty of leveling large fields. Some storm drains are needed to channel runoff from upslope areas.

This Niland soil is poorly suited to homesites and urban uses because of such limitations as a sandy surface, clayey underlying material, a high water table, and salinity. House slabs and footings need to be designed to compensate for the low bearing strength of the sandy surface layer. Revegetating disturbed areas around construction sites helps to control soil blowing. If the underlying clayey layer is exposed, the slabs need extra strength to withstand the stresses of shrinking and swelling. This stress can be reduced by irrigating the area frequently enough to maintain a constant moisture level in the soil.

Salt-tolerant plants are better suited for landscaping than most other plants.

Limitations for septic tank absorption fields are slow permeability of the underlying layer and a perched water table. Tile drainage prevents or reduces the water table condition but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines helps compensate for the slow permeability of the underlying clayey layer. A central sewage system is better for homes than a septic tank system.

In water impoundments such as reservoirs and fish ponds, excessive seepage can be avoided by mixing and compacting the sandy surface layer with the clayey substratum. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IVw-3, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 13.

126—Niland fine sand. This very deep, moderately well drained, nearly level soil is on flood plains and alluvial basins. Elevation is 35 feet above sea level to 230 feet below.

Included with this soil in mapping are areas of Rositas fine sand that have fine textured material at a depth between 40 and 60 inches, Meloland soils, and Glenbar soils that have a sandy surface.

Typically, the Niland soil to a depth of about 23 inches is very pale brown fine sand. Below this is pale brown silty clay to a depth of 60 inches. Some areas are hummocky. In some places there is a desert pavement of thin, flat sandstone fragments, water-worn gravel, and lime concretions.

Permeability is slow, and available water capacity is moderate to high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The soil is nonsaline or slightly saline to a depth of about 2 feet but may be moderately saline below this depth. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

The soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Sprinkler and drip irrigation apply water more efficiently than surface irrigation. Land smoothing prepares the ground for sprinkler or drip irrigation, and land leveling makes surface irrigation more efficient. Surface irrigation requires a grade of 0.2 to 0.3 percent per 100 feet, runs of about 300 feet, and large heads of water. Land leveling on slopes steeper than 0.3 percent tends to concentrate the sandy surface material on the lower end of the fields and expose silty clay material on the higher end. This gives greatly different water intake rates on different portions of the same field.

If the silty clay layer is exposed, considerable leaching of salt may be needed before these areas are productive. Closely spaced tile drains can provide leaching outlets to control salinity and to prevent the buildup of a high water table. Proper crop residue use and minimum tillage help to control soil blowing.

If irrigated, this soil is suited to field crops. Shallow-rooted, salt-tolerant crops grow best because of potential anaerobic conditions and a perched water table at the top of the saline clayey layer after irrigation. Alfalfa stands are difficult to maintain because of the slowly permeable substratum and a potential perched water table. There is potential for irrigated pasture grasses.

This Niland soil is poorly suited to homesites and urban areas because of the sandy surface, underlying clayey layer, and salinity. House slabs and footings need to be designed to compensate for the low bearing strength of the sandy surface layer. Revegetating disturbed areas around construction sites helps to control soil blowing. If the underlying clayey layer is exposed, house slabs need extra strength to withstand the stresses of shrinking and swelling. This can be accomplished by irrigating the area to maintain a constant moisture level in the soil.

Salt-tolerant plants are better suited to landscaping than most other plants.

Limitations for septic tank absorption fields are slow permeability of the underlying clayey layer and potential development of a perched water table. Tile drainage prevents or reduces water table conditions, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines helps compensate for the slow permeability. A central sewage system is better for homes than a septic tank system.

In water impoundments such as reservoirs and fish ponds, excessive seepage can be avoided by mixing and compacting the sandy surface layer with the clayey substratum. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIs-3, irrigated, and capablity subclass VIIIe, dryland. The Storie index rating is 36.

127—Niland loamy fine sand. This very deep, moderately well drained, nearly level soil is on low terraces. In some places the clayey substratum is tilted from the plane of the present surface. Elevation is 35 to 300 feet.

Included with this soil in mapping are small areas of Holtville, Imperial, Rositas, and Superstition soils.

Typically, the surface layer of this Niland soil is very pale brown loamy fine sand about 2 inches thick. Underlying this is stratified, crossbedded, reddish yellow sand, loamy sand, gravelly coarse sand, and loamy coarse sand about 21 inches thick. Below this, to a depth of 60 inches, is pink silty clay that is saline and contains 7 to 10 percent soft lime masses. A few areas have slopes of 2 to 5 percent. Most areas have a thin, weak vesicular crust. A desert pavement with desert varnish covers some of the surface.

Permeability is slow, and available water capacity is moderate to high. Surface runoff is slow, and the hazard of erosion is slight. There is a high hazard of soil blowing and abrasion to young plants. The soil is nonsaline or slightly saline to a depth of about 2 feet but may be moderately saline below this. Effective rooting depth is 60 inches or more.

This soil is used for desert recreation and military ordnance impact areas.

The soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Sprinkler or drip irrigation systems apply water more efficiently than surface irrigation. Land smoothing prepares the ground for sprinkler or drip irrigation, and land leveling makes surface irrigation more efficient. Surface irrigation requires a grade of 0.2 to 0.3 percent per 100 feet, runs of about 400 feet, and large heads of water. Land leveling on slopes more than 0.3 percent tends to concentrate the sandy surface material on the lower end. This gives greatly different water intake rates on different portions of the same field.

If the clayey layer is exposed, considerable leaching of salts may be needed before these areas are productive. Closely spaced tile drains can provide leaching outlets to control salinity and to prevent the buildup of a high water table.

If irrigated, this soil is suited to field crops. Shallow-rooted, salt-tolerant crops grow best because of potential anaerobic conditions and a perched water table at the top of the saline, clayey layer after irrigation. Alfalfa stands are difficult to maintain because of the slowly permeable clayey layer and the potential perched water table. There is potential for irrigated pasture grasses.

This Niland soil is poorly suited to homesites and urban areas because of the sandy surface, clayey subsurface layer, and salinity. House slabs and footings need to be designed to compensate for the low bearing strength of the sandy surface layer. Revegetating disturbed areas around construction sites as soon as possible helps to control soil blowing. If the clayey subsurface layer is exposed, house slabs need extra strength to withstand the stresses of shrinking and swelling. This can be accomplished by irrigating the area to maintain a constant moisture level.

Salt-tolerant plants are better suited for landscaping than most other plants.

Limitations for septic tank absorption fields are slow permeability and the potential development of a perched water table. Tile drainage prevents or reduces water table conditions, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines helps compensate for the slow permeability. A central sewage system is better for homes than a septic tank system.

In water impoundments such as reservoirs and fish ponds, excessive seepage can be avoided by mixing and compacting the sandy surface layer with the clayey layer. Large ponds need bank protection by riprap or such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIs-3, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 50.

128—Niland-Imperial complex, wet. These nearly level soils are on the edges of alluvial basins and on flood plains. Bodies of this unit are irregular in shape, but tend to have long axes parallel to the contour. Elevation is 100 feet above sea level to 230 feet below. Slopes are 0 to 2 percent.

This unit is about 40 percent Niland gravelly sand, wet, and 25 percent Imperial silty clay, wet. The rest is included soils. The Imperial soil commonly is in narrow areas adjacent to the drainageways, but is also in irregular areas between drainageways.

Included with these soils in mapping are thin, linear beach ridges of Carsitas and Rositas soils and Imperial soils that have a sandy surface layer. Also included are areas of Imperial silty clay, saline, and Meloland very fine sandy loam, wet.

The Niland soil is very deep. It formed in alluvial materials of diverse sources. Irrigation has caused a perched water at a depth of 20 to 36 inches which can rise to a depth of 18 inches during periods of heavy irrigation. Typically, the Niland soil to a depth of about 23 inches is stratified, very pale brown gravelly sand and sand. Below this is pale brown silty clay to a depth of 60 inches.

Permeability of the Niland soil is slow, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The soil is nonsaline or slightly saline to a depth of about 2 feet but may be moderately saline below this depth. The effective rooting depth is 60 inches or more.

The Imperial soil is very deep. It formed in clayey sediment from mixed sources. Irrigation has caused a perched water table at a depth of 36 to 60 inches. Efflorescences of gypsum and brown stains are common in the cracks and pores. Typically, the Imperial soil is pinkish gray and light brown silty clay to a depth of 60 inches or more.

Permeability of the Imperial soil is slow, and available water capacity is very high. Surface runoff is slow, and the hazard of erosion is slight. The soil is slightly saline throughout. The effective rooting depth is 60 inches or more.

Most areas of these soils are idle or used for recreation and wildlife habitat. Some areas have been leveled and are used for tomatoes, squash, field crops, and pasture. These soils are used extensively in winter for tomatoes and squash. Good air drainage gives an appreciably longer frost-free season for these crops than in most of the Imperial Valley. Some areas are used for irrigated pasture.

If irrigated, these soils are suited to field crops but, because of slow permeability and numerous saline spots, shallow-rooted, salt-tolerant crops grow best. Alfalfa stands are difficult to maintain because of the slowly permeable subsurface material and perched water table.

Suitable irrigation methods are border, furrow, sprinkler, and drip. Onsite investigation is needed for irrigation design and field layout. Land leveling, with large cuts and fills, or cross slope irrigation make surface irrigation more efficient on the natural slopes of 0.5 to 1.5 percent. Land leveling tends to concentrate the sandy surface materials, giving different water intake rates on different parts of the same field. The silty clay layer is saline in many areas, even on different parts of the same field, and requires considerable leaching before crop production. Closely spaced tile drains help to control salinity and to prevent the buildup of a high water table. Most areas of this unit are dissected by deep drainageways carved by runoff from the upslope alluvial fans. These add to the difficulty of leveling large fields, but storm drains help to channel runoff from upslope areas.

These soils are poorly suited to homesites and urban uses because of the sandy surface, clayey layer, high water table, and salinity. The low bearing strength of the sandy surface layer affects design of house slabs and footings. Revegetating exposed areas around construction sites helps to control soil blowing. If the clayey layer is exposed, house slabs need extra strength to withstand the stresses of shrinking and swelling, though maintaining a constant moisture level in the soil by irrigation helps reduce this stress.

Limitations for septic tank absorption fields are slow permeability of the subsurface material and a perched water table. Tile drainage prevents or reduces water table conditions; however, obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. Extra length of septic tank absorption lines helps compensate for the slow permeability. A central sewage system is better for homes than a septic tank system.

In water impoundments such as reservoirs and fish ponds, excessive seepage can be avoided by mixing and compacting the sandy surface layer with the clayey material. Large ponds need bank protection by riprap or by such vegetation as a bermudagrass to prevent wave erosion.

Irrigated areas of these soils have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IVw-3, irrigated, and capability unit VIIIw, dryland. The Storie index rating is 17.

129—Pits. The upper layers of soil materials have been removed from this miscellaneous area, and this unit lies 3 to 20 feet below the natural surface of the land. Drainage ranges from excessively drained to poorly drained. Elevation is 30 to 300 feet.

Included with this unit in mapping are small areas of undisturbed soils, spoil piles, and screening dumps.

Runoff is commonly ponded, and the erosion hazard is slight. Rooting is unrestricted to a depth of 60 inches, except where the water table is high. Sediment is deposited in the bottoms where runoff is trapped.

Areas of this unit are commonly used for solid waste disposal. Where suitable cover soil is available, sanitary landfills are effective but need to be protected from runoff water where permeable site and fill materials can contaminate ground water.

This unit is also used as wildlife habitat. There are small ponds in areas that have a high water table, and these support warmwater fish, frogs, muskrats, and waterfowl. The pond edges have a rich vegetation of cattails, saltcedar, baccharis, mesquite, and arrowweed. Areas of the unit not affected by a water table commonly have a better growth of shrubs and herbs than the surrounding desert because of collected runoff waters. These areas provide food and cover for doves, quail, and rabbits.

Areas of this unit may be graded or filled and reclaimed for agricultural or urban purposes, though suitability and limitations call for onsite investigation of the available soil materials.

This map unit is in capability subclass VIIIe. The Storie index rating is less than 10.

130—Rositas sand, 0 to 2 percent slopes. This very deep, somewhat excessively drained, nearly level soil is on flood plains, basins, and terraces. It formed in alluvial sand from diverse sources. Elevation is 300 feet above sea level to 200 feet below.

Included with this soil in mapping are small areas of Carsitas, Vint, Rositas, and Niland sands and a few areas of Rositas fine sand, 2 to 9 percent slopes.

Typically, the surface layer of this Rositas soil is stratified, pink and reddish yellow sand and coarse sand to a depth of 27 inches. The underlying material is pink fine sand to a depth of 60 inches or more. In some places the colors are less bright. Some areas are sandy soils that contain, within a depth of 10 to 40 inches, thin strata of gravelly sand. In some areas are sandy soils that have thin strata of gravelly sand and material finer than loamy fine sand. About 200 acres of this unit have stones or cobbles on the surface.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. There is high hazard of soil blowing and abrasion to young plants. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation and desert wildlife habitat. Some areas are a source of sand.

This soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Sprinkler and drip irrigation are the most efficient means of watering crops. Land smoothing is needed in most places before an irrigation system is installed. Adequate design is important because frequent irrigation is needed on this droughty soil during summer. If a perched water table develops, widely spaced tile drains help to control salinity and lower the water table. Proper use of crop residue and minimum tillage help to control soil blowing.

This soil is suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue improves the water- and nutrient-holding capacities of this sandy, droughty soil.

This soil is well suited to homesites and urban areas, though its sandy texture affects most uses. Revegetating disturbed areas around construction sites helps control soil blowing.

Most climatically adapted plants are suited for landscaping, but require a careful program of irrigation and fertilization.

Septic tank absorption fields can function well, but there is a hazard of ground water contamination from septic tank absorption effluent because of rapid permeability. Widely spaced tile drains can reduce the perched water table resulting from heavy use of absorption fields. However, obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

This soil is too permeable to be good material for water impoundments. Ponds and reservoirs need an impervious lining to prevent seepage.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IVs-4, irrigated, and capability subclass VIIIe. The Storie index rating is 57.

131—Rositas sand, 2 to 5 percent slopes. This very deep, somewhat excessively drained, gently sloping soil is on middle and upper alluvial fans and the ancient beach line of old lake Cahuilla. It formed in alluvial sands of diverse origin. Elevation is 35 to 350 feet.

Included with this soil in mapping are small areas of Carsitas and Niland soils. This soil adjoins Rositas loamy coarse sand, 2 to 9 percent slopes, along the San Diego County line in the lower Borrego Valley.

Typically, the surface layer of this Rositas soil is stratified pink and reddish yellow sand and coarse sand to a depth of 27 inches. The underlying material is pink fine sand to a depth of 60 inches or more. In some places the soil colors are less bright. In some areas the soil is stratified, sandy, and has lenses finer than loamy fine sand, and in some areas the soil is dominantly coarse sand.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The effective rooting depth is 60 inches or more.

The soil is used for desert recreation and desert wildlife habitat. Some areas are a source of sand.

This soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. The most efficient irrigation methods are sprinkler and drip. Land smoothing is needed before an irrigation system is installed. An adequate design is very important because of the need for frequent irrigation on this droughty soil during the summer. If a perched water table develops, widely spaced tile drains help to lower the water table.

This soil is suited to all climatically adapted crops, including citrus. If irrigated, incorporating barnyard manure and crop residue into the surface layer helps to improve the soil's water- and nutrient-holding capacities. Proper crop residue use and minimum tillage will help control soil blowing.

This Rositas soil is well suited to homesites and urban areas, though the sandy texture affects use. Revegetating areas surrounding construction sites helps control soil blowing. Most climatically adapted plants are suited for landscaping, but require a careful program of irrigation and fertilization.

Septic tank absorption fields usually function well, but there is a hazard of ground water contamination from septic tank effluent because of rapid permeability. If a perched water table develops with heavy absorption field use, widely spaced tile drains can reduce this condition. However, obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

This soil is too permeable to be good material for water impoundments, and slope is an additional limitation. Ponds and reservoirs need an impervious lining to prevent rapid seepage.

This soil has poor potential for desert wildlife habitat because of low precipitation. A sparse shrub growth of creosotebush, wingscale, and mesquite provides some food and cover for wildlife.

This map unit is in capability unit IVs-4, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 54.

132—Rositas fine sand, 0 to 2 percent slopes. This very deep, somewhat excessively drained, nearly level soil is on flood plains, basins, and terraces. It formed in alluvial or eolian sands from diverse sources. Elevation is 300 feet above sea level to 200 feet below.

Included with this soil in mapping are areas of Niland, Meloland, Rositas, and Vint soils; small areas of Antho, Holtville, and Superstition soils are in blowouts and swales. Some areas of Rositas fine sand, 2 to 9 percent slopes, are on low dunes.

Typically, this Rositas soil is reddish yellow fine sand to a depth of 60 inches. In some places soil colors are less bright.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. There is a high hazard of soil blowing and abrasion to young plants. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation and desert wildlife habitat.

This soil has potential for irrigated farming, but development depends on an adequate supply of good quality irrigation water. Agricultural development requires land leveling or smoothing and careful irrigation design and management. Sprinkler and drip irrigation are the most efficient means of watering crops. Because of rapid water intake rates, surface irrigation requires a grade of about 0.3 percent, runs of about 250 feet, and high heads of water. Design of the system is very important because frequent irrigation is needed on this droughty soil during the summer. If a perched water table develops, widely spaced tile drains help to control salinity and lower the water table. Proper use of crop residue and minimum tillage help to control soil blowing.

This soil is suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue improves the soil's water- and nutrient-holding capacities.

This Rositas soil is well suited to homesites and urban areas, though its sandy texture affects use. Revegetating areas surrounding construction sites helps to control soil blowing. Most climatically adapted plants are suited to landscaping, but require a careful program of irrigation and fertilization.

Septic tank absorption fields generally function well, but there is a hazard of ground water contamination from septic tank effluent because of rapid permeability. If a perched water table builds up with heavy use of absorption fields, widely spaced tile drains can reduce this condition. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

This soil is too permeable to be good material for water impoundments. Ponds and reservoirs need an impervious lining to prevent seepage.

This soil has fair potential for desert wildlife habitat. Some areas support good stands of creosotebush and other shrubs, including white bursage, ephedra, desert buckwheat, and mesquite, which provide food and cover for rabbits, quail, and doves.

This map unit is in capability unit IIIs-4, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 62.

133—Rositas fine sand, 2 to 9 percent slopes. This very deep, somewhat excessively drained, gently to moderately sloping soil is on dunes, sand hills, and alluvial fans. Elevation is 200 feet below sea level to 350 feet above.

Included with this soil in mapping are small interdune areas of Antho, Holtville, Indio, Superstition, and Vint soils and some areas of soil that have slopes of less than 2 percent.

Typically, this Rositas soil is reddish yellow fine sand to a depth of 60 inches. In some places soil colors are less bright. About 400 acres of this soil on the west side of Superstition Mountain has spots that have a stony or cobbly surface.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation and desert wildlife habitat.

There is potential for irrigated farming, but development depends on an adequate supply of good quality irrigation water. Considerable land smoothing is needed for agricultural development, especially in dune areas. Sprinkler and drip irrigation are the most efficient means of watering crops, and design of the system is very important because frequent irrigation is needed on this droughty soil during summer. If a perched water table develops, widely spaced tile drains help provide leaching outlets for salinity control and help lower the water table.

Proper use of crop residue and minimum tillage help to control soil blowing.

This soil is suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue improves the soil's water- and nutrient-holding capacities.

This Rositas soil is well suited to homesites and urban areas, though its sandy texture affects use. Revegetating areas surrounding construction sites helps to control soil blowing. Windbreaks are needed in most areas to prevent damage from blowing sand. Most climatically adapted plants are suited for landscaping, but require a careful program of irrigation and fertilization.

Septic tank absorption fields generally function well, but there is a hazard of ground water contamination from septic tank effluent because of rapid permeability. If a perched water table builds up with heavy use of absorption fields, widely spaced tile drains can reduce the condition. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

This soil is too permeable to be good material for water impoundments. Ponds and reservoirs need an impervious lining to prevent seepage.

This soil has fair potential for desert wildlife habitat. Some areas support good stands of creosotebush and other shrubs, including white bursage, ephedra, desert buckwheat, and mesquite, which provide food and cover for rabbits, quail, and doves.

This map unit is in capability unit IIIs-4, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 56.

134—Rositas fine sand, 9 to 30 percent slopes. This very deep, somewhat excessively drained, strongly sloping or moderately steep soil formed in eolian sands of diverse origin. Elevation is 150 to 350 feet.

Included with this soil in mapping are some areas of Rositas soils that have slopes of less than 9 percent. Included soils make up about 10 percent of the unit.

Typically, this Rositas soil is reddish yellow fine sand to a depth of 60 inches. In some places the soil is loamy fine sand, or the soil colors are less bright.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

There is limited potential for irrigated farming, but development depends on stabilization of moving sand dunes and protection from wind, as well as on an adequate supply of good quality irrigation water. Much land smoothing is needed for agricultural development. Sprinkler and drip irrigation are the most efficient methods. Adequate design of the system is very important because frequent irrigation is needed during summer.

This soil is suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue improves its water- and nutrient-holding capacities. Use of all crop residue and minimum tillage help to control soil blowing.

This Rositas soil is poorly suited to homesites and urban areas because of soil blowing and the sandy texture. Revegetating disturbed areas around construction sites helps to control soil blowing. Use of farmstead windbreaks also helps to control soil blowing and enhances the environment around buildings.

Good irrigation and fertilization programs help to maintain most climatically adapted landscaping plants.

Septic tank absorption fields are moderately or severely limited by slope, and there is a hazard of ground water contamination from septic tank effluent.

This soil is too permeable and sloping to be good material for water impoundments. Ponds and reservoirs need an impervious lining to prevent rapid seepage.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse shrub growth.

This map unit is in capability unit VIe-4, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 49.

135—Rositas fine sand, wet, 0 to 2 percent slopes. This very deep, nearly level soil is on flood plains and alluvial basin floors. It formed in eolian and alluvial sediments of mixed origin. Elevation is 150 feet above sea level to 230 feet below.

Included with this soil in mapping are areas of Vint loamy fine sand, and areas of Superstition, Carsitas, and Antho soils on East Mesa, which are affected by seepage.

Typically, this Rositas soil is reddish yellow fine sand to a depth of 60 inches or more. In some areas a fine textured stratum is at a depth of 40 to 60 inches. In some places soil color is less bright.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. There is a high hazard of soil blowing and abrasion to young plants. The soil is nonsaline or slightly saline throughout. The effective rooting depth is 60 inches or more. Irrigation or seepage causes a perched water table at a depth of 36 to 60 inches, and the water table may rise to a depth of 18 inches during periods of heavy irrigation.

This soil is used as cropland. It is suited to all climatically adapted crops, including citrus, and is preferred for spring melons because of suitable soil temperature. The soil washes easily from carrots and onions. Incorporating barnyard manure and crop residue improves the soil's water- and nutrient-holding capacities. Proper crop residue use and minimum tillage help to control soil blowing.

Sprinkler and drip irrigation are the most efficient means of watering crops. Because of rapid water intake rates, surface irrigation in borders and furrows requires runs of about 250 feet, high heads of water, and a grade of about 0.3 percent per 100 feet. Adequate irrigation system design is important because frequent irrigation is needed during summer. Widely spaced tile drains can prevent a high water table and provide leaching outlets to control salinity.

This Rositas soil is suited to homesites and urban areas, though sandy texture and a high water table affect use. Revegetating disturbed areas around construction sites helps to control soil blowing. Salt-sensitive landscaping plants can be maintained by drainage.

Limitations for septic tank absorption fields are a high water table and possible ground water contamination from septic tank effluent. Tile drainage prevents or reduces these conditions, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. A central sewage system is better for homes on this soil than a septic tank system.

This soil is too permeable to be good material for water impoundments, so ponds and reservoirs need an impervious lining to prevent seepage.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, this soil can be ponded and managed as wetland for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIIw-4, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 36.

136—Rositas loamy fine sand, 0 to 2 percent slopes. This very deep, somewhat excessively drained, nearly level soil is on terraces. It formed in alluvial or eolian sands from diverse sources. Elevation is 35 feet to 300 feet.

Included with this soil in mapping are areas of Antho, Superstition, and Holtville soils and low dunes of Rositas fine sand. About 300 acres of this unit are Rositas soils that have gently undulating slopes of 2 to 5 percent. About 100 acres adjacent to Interstate 8 are shallow borrow areas with bottoms of sandy material containing a few lime segregations. About 10 acres, on East Mesa east of Holtville, have been excavated and lined as a holding pond for geothermal well effluent.

Typically, the surface layer of this Rositas soil is light brown loamy fine sand about 4 inches thick. The underlying material is pink and very pale brown fine sand to a depth of 60 inches, and is as much as 2 percent soft masses and concretions of lime. The segregated lime is not typical of the Rositas series. Some subsurface layers contain gravel or thin gravelly layers. The surface layer in some areas is fine sand or fine sandy loam.

In some places there are soils that have a sandy profile containing a few soft lime segregations and a few thin lenses of fine sandy loam, silt loam, or silty clay loam. In other areas are soils that do not have appreciable segregated lime.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. There is a high hazard of soil blowing and abrasion to young plants. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

There is potential for irrigated farming. Development depends on an adequate supply of good quality irrigation water, which entails land leveling or smoothing and careful irrigation design and management. Sprinkler and drip irrigation are the most efficient means of watering crops. Because of rapid water intake rates, surface irrigation requires runs of about 250 feet, high heads of water, and a grade of about 0.3 percent per 100 feet. Adequate irrigation system design is important because of the frequent irrigations needed during summer. If a perched water table develops, widely spaced tile drains can provide leaching outlets to control salinity and lower the water table. Soil blowing can be controlled by proper crop residue use and minimum tillage.

This soil is suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue improves the water- and nutrient-holding capacities of this soil.

This Rositas soil is well suited to homesites and urban areas, though its sandy texture affects use. Revegetating disturbed areas around construction sites helps to control soil blowing. Most climatically adapted plants are suited to landscaping, but require a careful program of irrigation and fertilization.

Septic tank absorption fields should function well but there is a hazard of ground water contamination from septic tank effluent because of rapid permeability. If a perched water table develops, widely spaced tile drains can reduce the condition. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

This soil is too permeable to be good material for water impoundments, so ponds and reservoirs need an impervious lining to prevent seepage.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIIs-4, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 85.

137—Rositas silt loam, 0 to 2 percent slopes. This very deep, somewhat excessively drained, nearly level soil is on flood plains, basins, and terraces. It formed in alluvial or eolian materials from diverse sources. Elevation is 35 to 300 feet.

Included with this soil in mapping are areas of Vint and Meloland soils and scattered coppice dunes of Rositas fine sand.

Typically, the surface layer of this Rositas soil is pink silt loam about 12 inches thick. The underlying material is reddish yellow fine sand to a depth of 60 inches. In some places the surface layer is sand, clay loam, sandy clay loam, or fine sandy loam. Some areas have soil colors that are less bright. A few small areas of this soil have 1 to 5 percent soft masses of lime.

Permeability is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of water erosion is slight. There is a moderate hazard of soil blowing and abrasion to young plants. The effective rooting depth is 60 inches or more.

This soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Land smoothing is needed for sprinkler or drip irrigation. Land leveling is needed for surface irrigation, and this radically changes the characteristics of the soil if the sandy strata are exposed. For surface irrigation, fields need to be leveled to a grade of about 0.2 percent per 100 feet with runs no longer than 1/4 mile. An initial leaching for toxic salt reduction is needed in some places. Widely spaced tile drains can reduce a perched water table. Soil blowing can be controlled by proper crop residue use and minimum tillage.

This soil is suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue helps maintain good tilth and improves water intake of the easily compacted surface layer.

This Rositas soil is well suited to homesites and urban areas, though dustiness and sandy texture of the subsurface layer affect use. Revegetating disturbed areas around construction sites help to reduce soil blowing. Most climatically adapted plants are suited for landscaping.

Septic tank absorption fields can function well, but there is a hazard of ground water contamination from septic tank effluent in the permeable subsurface layers. If a perched water table builds up with heavy use of absorption fields, widely spaced tile drains can reduce the condition. However, obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

This soil is too permeable to be good material for water impoundments, so ponds and reservoirs need an impervious lining to prevent seepage.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIs-1, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 90.

138—Rositas-Superstition loamy fine sands. These nearly level soils formed in terrace sediment of West Mesa and are so intricately mixed that they are not separated on the soil map. Elevation is 30 to 300 feet.

The Rositas soils are about 45 percent of the unit, and the Superstition soils about 35 percent. The remaining 20 percent consists of Antho and Laveen soils; stratified soils that contain 1 to 4 percent, by volume, segregated lime and have contrasting layers of silt loam and fine sand to a depth of 40 inches; and a small area that has slopes of 2 to 5 percent.

About 35 acres of this unit near Plaster City are covered with a plaster dump several feet thick. A few acres in the lower Borrego Valley adjoin and extend into an area mapped Sloping Gullied Land in San Diego County.

The Rositas soil is very deep and somewhat excessively drained. It formed in alluvial or eolian material of diverse sources. Typically, the surface layer is light brown, loamy fine sand about 4 inches thick. The underlying material is pink and very pale brown fine sand to a depth of 60 inches, and has as much as 2 percent soft masses and concretions of lime. The segregated lime is not typical of the Rositas series.

Permeability of this Rositas soil is rapid, and available water capacity is low. Surface runoff is slow, and the hazard of erosion is slight. There is a high hazard of soil blowing and abrasion to young plants. The effective rooting depth is 60 inches or more.

The Superstition soil is very deep and somewhat excessively drained. It formed in sandy alluvial sediment of diverse origin. Typically, the surface layer is pink loamy fine sand about 6 inches thick. The underlying material is pink loamy fine sand about 11 inches thick, and has about 6 percent, by volume, prominent soft masses and concretions of lime. Below this is pink and pinkish white sand to a depth of several feet. Very few lime segregations are below a depth of 36 inches.

Permeability of this Superstition soil is moderately rapid, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high. The effective rooting depth is 60 inches or more.

These soils are used for desert recreation and military ordnance impact areas.

These soils have potential for irrigated farming, but development depends on an adequate supply of good quality irrigation water. Development also requires land leveling or smoothing and careful irrigation design and management. Sprinkler and drip irrigation are the most efficient means of watering crops on these soils. Because of rapid water intake rates, surface irrigation requires a grade of about 0.3 percent per 100 feet, runs of about 250 feet, and high heads of water. Frequent irrigation is needed during summer. If a perched water table develops, widely spaced tile drains can control salinity and lower the water table. Soil blowing can be controlled by proper use of crop residue and minimum tillage.

These soils are suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue improves the soil's water- and nutrient-holding capacities.

The soils are well suited to homesites and urban areas, though their sandy texture affects use. Revegetating disturbed areas around construction sites helps to control soil blowing. Most climatically adapted plants are suited to landscaping, but require a careful program of irrigation and fertilization.

Septic tank absorption fields can function well but there is a hazard of ground water contamination from septic tank effluent. If a perched water table builds up with heavy use of absorption fields, widely spaced tile drains can reduce the condition. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain.

These soils are too permeable to be good material for water impoundments, so ponds and reservoirs need an impervious lining to prevent rapid seepage.

These soils have poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIIs-4, irrigated, and capability subclass VIIIe, dryland. The Storie index rating is 85.

139—Superstition loamy fine sand. This very deep, excessively drained, nearly level soil is on old terraces and fans. It formed in sand alluvial sediment of diverse origin. Elevation is 40 to 300 feet (fig. 11).

Included with this soil in mapping are small areas of Superstition soils that have slopes of 1 to 9 percent, and areas of Rositas, Antho, Holtville, and Laveen soils.

Typically, the surface layer of this Superstition soil is pink loamy fine sand about 6 inches thick. The underlying material is pink loamy fine sand about 11 inches thick and has about 6 percent soft masses and concretions of lime. Below this, to a depth of several feet, is pink and pinkish white sand that has very few lime segregations below a depth of 36 inches. In some places the surface layer is fine sand or fine sandy loam. In other places there are strata of coarse sand or gravelly sand at a depth of 10 to 40 inches.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. There is slight to moderate hazard of soil blowing and abrasion to young plants. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

The soil has potential for irrigated farming, but development depends on an adequate supply of good quality irrigation water. Land smoothing for sprinkler irrigation or land leveling for surface irrigation is required if this land is cultivated. Sprinkler and drip irrigation are the most efficient means of watering crops. Because of rapid water intake rates, surface irrigation requires a grade of about 0.3 percent, runs of about 250 feet, and high heads of water. Frequent irrigation is needed on this droughty soil during summer. If a perched water table develops, widely spaced tile drains can control salinity and lower the water table. Proper crop residue use and minimum tillage help to control soil blowing.

This soil is suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue improves the soil's water- and nutrient-holding capacities.

This Superstition soil is well suited to homesites and urban areas, though the sandy texture affects use. Revegetating disturbed areas around construction sites helps to control soil blowing. Most climatically adapted plants are suited for landscaping, but require a careful program of irrigation and fertilization.

Septic tank absorption fields can function well, but there is a hazard of ground water contamination from septic tank effluent. If a perched water table builds up with heavy use of absorption fields, widely spaced tile drains can reduce the condition. Tile and absorption fields need to be designed to filter effluent through several feet of soil before it enters the tile drain.

This soil is too permeable to be good material for water impoundments, so ponds and reservoirs need an impervious lining to prevent seepage.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIIs-4, irrigated, and capability subclass VIIe, dryland. The Storie index rating is 85.

140—Torriorthents-Rock outcrop complex, 5 to 60 percent slopes. This complex consists of areas of volcanic extrusions along the southeastern edge of the Salton Sea, along the edge of Fish Creek Mountains bordering West Mesa, and in a few small areas on West Mesa. Elevation is 400 feet above sea level to 230 feet below.

Soil material that has little or no profile development and contains variable amounts of rock fragments makes up about 80 percent of this unit; the remaining 20 percent is Rock outcrop.

The Torriorthents are excessively drained soils formed in unconsolidated materials and range from very shallow on the upper slopes to many feet deep on the toe slopes. Most of these areas are more than 60 inches deep. Texture of the soil material ranges from loam to loamy sand. Rock fragments generally make up more than 15 percent and commonly more than 35 percent by volume.

Surface runoff is rapid, and the hazard of erosion is moderate. The permeability, available water capacity, and effective rooting depth are variable.

The Rock outcrops are mostly rhyolitic rock materials in the volcanic extrusions along the Salton Sea, and are granitic rock in the Fish Creek Mountains.

This complex is used for desert recreation and has poor potential for desert wildlife habitat. The igneous rock areas near the Salton Sea are used for road surface aggregate, riprap, and as a source of pumice building blocks. Most areas have little other use or potential.

This map unit is in capability subclass VIIIe, dryland. The Storie index rating is 9.

141—Torriorthents and Orthids, 5 to 30 percent slopes. This unit is made up of deep, well drained to excessively drained soils on terrace escarpments and old alluvial fans dissected by geologic erosion. Local relief is less than 25 feet. The soils formed in mixed, unconsolidated alluvial sediment. Elevation is 350 feet above sea level to 200 feet below.

Torriorthents have little or no profile development. The Orthids have significant lime accumulation or other evidence of profile development. Delineated areas of this unit may contain both of the major soils, or only one.

Included with this unit in mapping are some dissected areas of Superstition and Laveen soils. Saline areas are common. This unit adjoins Sloping Gullied Land in San Diego County and is used to delineate the same kind of landscape along the county line in the lower Borrego Valley. About 120 acres of channeled Rositas soils that have slopes of 1 to 5 percent are included with this unit in the lower Borrego Valley.

Permeability of the Torriorthents and Orthids ranges from slow to rapid, and available water capacity is low to very high. Surface runoff is rapid, and the hazard of erosion is high. The effective rooting depth is 60 inches or more.

These soils are used for desert recreation.

The soils in their natural state are not suited to farming. Development and reclamation for irrigation is possible, but is not considered economically feasible.

Limitations and potentials for homesite and urban uses can be determined only by onsite investigation of the soil materials.

These soils have poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability subclass VIIIe. The Storie index rating is less than 20.

142—Vint loamy very fine sand, wet. This very deep, nearly level soil is on basin floors and flood plains. It formed in alluvial and eolian sediments from diverse sources. Elevation is 35 feet above sea level to 230 feet below.

Typically, the surface layer of this Vint soil is light brown loamy very fine sand about 10 inches thick. This is underlain by pink and light brown loamy fine sand to a depth of 60 inches, with several thin lenses of heavy silt loam between depths of 10 and 40 inches. In some places the surface layer is loam, very fine sandy loam, and fine sandy loam.

Irrigation has caused a perched water table at a depth of 36 to 60 inches. The water table may rise to a depth of 18 inches below the surface during periods of heavy irrigation.

Permeability of this Vint soil is moderately rapid, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. There is a moderate hazard of soil blowing and abrasion to young plants. The soil is nonsaline or slightly saline throughout. The effective rooting depth is 60 inches or more.

This soil is used for all climatically suited field crops, vegetable crops, and citrus.

If irrigated, this soil is well suited to growing carrots and onions because the roots can be cleaned easily. Sprinkler and drip irrigation are the most efficient means of watering crops. Because of rapid water intake rates, surface irrigation on borders and furrows requires runs of about 300 feet, high heads of water, and a slope of about 0.3 percent per 100 feet. Widely spaced tile drains can prevent a high water table and provide leaching outlets for salinity control. Proper crop residue use and minimum tillage help to control soil blowing.

This Vint soil is suited to homesites and urban areas, though sandy texture of the soil and high water table affect use. Revegetating disturbed areas around construction sites helps to control soil blowing. Drainage can maintain salt-sensitive landscaping plants.

Limitations for septic tank absorption fields are a high water table and possible ground water contamination from septic tank effluent. Tile drainage prevents or reduces this condition, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it enters the tile drain. A central sewage system is better for homes than a septic tank system.

This soil is too permeable to be good material for water impoundments, so ponds and reservoirs need an impervious lining to prevent seepage.

Irrigated areas have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlfe populations, this soil can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIw-4, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 57.

143—Vint fine sandy loam. This very deep, well drained, nearly level soil is on flood plains, basins, and terraces. It formed in alluvial or eolian materials from diverse sources. Elevation is 35 to 300 feet.

In some areas the soil has strata of fine sand, very fine sand, loamy very fine sand, and silt loam, which average fine sandy loam. Included with this soil in mapping are areas of Rositas, Indio, and Meloland soils, and some areas of coppice dunes of Rositas fine sand.

Typically, the surface layer of this Vint soil is pinkish gray fine sandy loam about 12 inches thick. The underlying material is stratified light brown and pink loamy fine sand to a depth of 60 inches. Several thin lenses of silt loam, fine sand, very fine sand, or loamy very fine sand are at a depth between 10 and 40 inches. In some areas the surface layer is silt loam or clay loam.

Permeability is moderately rapid, and available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight, although geologic erosion has etched most areas with rills and arroyos. The hazard of soil blowing is moderate. The effective rooting depth is 60 inches or more.

This soil is used for desert recreation.

The soil has potential for irrigated farming, but development depends on an adequate supply of good quality water. Sprinkler and drip irrigation require land smoothing. Land leveling is needed to prepare the ground for surface irrigation, though it radically changes the characteristics of this soil if the sandy substratum is exposed. For surface irrigation, field slope needs to be about 0.2 percent per 100 feet and runs not longer than 1/4 mile. An initial leaching for toxic salt reduction is needed in some areas. If a perched water table develops, widely spaced tile drains can control salinity and lower the water table.

This soil is suited to all climatically adapted crops, including citrus. Incorporating barnyard manure and crop residue helps maintain good tilth and improves water intake of the easily compacted surface layer. Proper crop residue use and minimum tillage can help to control soil blowing.

This Vint soil is well suited to homesites and urban areas, though dustiness and sandy soil materials affect use. Revegetating disturbed areas around construction sites helps to control soil blowing. Most climatically adapted plants are suitable for landscaping.

Septic tank absorption fields can function well but there is a hazard of ground water contamination from septic tank effluent in the permeable subsurface strata. If a perched water table builds up with heavy use of absorption fields, widely spaced tile drains can reduce the condition. However, obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain.

This soil is too permeable to be good material for water impoundments, so ponds and reservoirs need an impervious lining to prevent seepage.

This soil has poor potential for desert wildlife habitat because of low precipitation and sparse vegetation.

This map unit is in capability unit IIs-1, irrigated, and capability subclass VIIe, dryland. The Storie index rating is 100.

144—Vint and Indio very fine sandy loams, wet. This undifferentiated unit consists of deep, nearly level soils on the bed of old Lake Cahuilla. The soil bodies are irregular in shape and may consist of one or both of the major members in an unpredictable pattern. Elevation is 35 feet above sea level to 230 feet below.

Included with these soils in mapping are areas of Rositas and Meloland soils.

Irrigation has caused a perched water table in these soils at a depth of 36 to 60 inches. The water table may rise to a depth of 18 inches below the surface during periods of heavy irrigation.

Vint very fine sandy loam, wet, is very deep. It formed in alluvial and eolian sediments from diverse sources. Typically, the surface layer is light brown very fine sandy loam about 10 inches thick. The underlying material is stratified light brown and pink loamy fine sand and has thin lenses of silt loam to a depth of 40 inches. Below this is pinkish gray and light brown silty clay to a depth of 60 inches. In some places the surface layer is clay loam or sandy clay loam. In other places the silty clay substratum is at a depth of less than 40 inches.

This Vint soil has moderately rapid permeability to a depth of 40 inches, and slow permeability below this depth. Available water capacity is moderate. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate. The soil is nonsaline to moderately saline to a depth of about 40 inches and slightly saline below this depth. The effective rooting depth is 60 inches or more.

Indio very fine sandy loam, wet, is deep. It formed in alluvial and eolian sediments from diverse sources. Typically, the surface layer is light brown very fine sandy loam about 12 inches thick. The underlying material is stratified light brown and pink light silt loam and loamy very fine sand to a depth of 40 inches. Below this is pinkish gray and light brown silty clay to a depth of 60 inches. In some areas the surface layer is clay loam or sandy clay loam. In other areas the silty clay substratum is at a depth of less than 40 inches.

Indio very fine sandy loam, wet, has moderate permeability to a depth of 40 inches and slow permeability below this depth. Available water capacity is high to very high. Surface runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate. The soil is nonsaline to a depth of about 40 inches, but it is slightly saline below this depth. The effective rooting depth is 60 inches or more.

These soils are used as cropland.

The soils are suited to all field and vegetable crops of the area. They are not well suited to citrus because of a perched water table and anaerobic conditions for a short time after irrigation, but are preferred for spring melons because of favorable soil temperature. The soils wash easily from carrots and onions. Incorporating barnyard manure and crop residue improves the tilth and the water- and nutrient-holding capacities of these easily compacted soils. Proper crop residue use and minimum tillage can help to control soil blowing.

Suitable irrigation methods are border, furrow, corrugation, and sprinkler. Border and furrow are used for most crops, but sprinkler is commonly used to germinate such delicate, high value crops as lettuce. For efficient surface irrigation, fields need to be leveled to a grade of about 0.2 percent per 100 feet with runs no longer than 1/4 mile. Moderately spaced tile drains can control the perched water table that forms on top of the slowly permeable layers and can provide leaching outlets for salinity control. If the tile system is adequate, salinity can be controlled by ordinary irrigation management.

These soils are moderately well suited to homesites and urban areas, though dustiness and a high water table affect use. Revegetating disturbed areas around construction sites helps to control dustiness.

Salt-sensitive landscaping plants generally need drainage.

Limitations for septic tank absorption fields are a high water table and slow permeability in the clayey substratum. Tile drainage prevents or reduces water table conditions, but obstacles to tile installation and poor access to outlets are common. Tile and absorption fields need to be designed to filter septic effluent through several feet of soil before it can enter the tile drain. A central sewage system is better for homes than a septic tank system.

In water impoundments such as reservoirs and fish ponds, excessive seepage can be avoided by mixing and compacting the loamy surface layer with the clayey substratum. Large ponds need bank protection by riprap or by such vegetation as bermudagrass to prevent wave erosion.

Irrigated areas of this soil have good potential for cottontail rabbits, jackrabbits, California quail, mourning dove, and ring-necked pheasant. Nonirrigated areas have poor potential for wildlife habitat because of low precipitation and sparse vegetation. To encourage added wildlife populations, these soils can be ponded and managed as wetland habitat for ducks, geese, and other wetland wildlife.

This map unit is in capability unit IIw-3, irrigated, and capability subclass VIIIw, dryland. The Storie index rating is 60.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of wetness or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the system of land capability classification used by the Soil Conservation Service is explained, and the estimated yields of the main crops and hay plants are presented for soils that are cultivated.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, an others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

Approximately 500,000 acres of the survey area were used for crops and pasture in 1974, according to the Imperial Irrigation District's Annual Inventory of Areas Receiving Water. Of this total about 160,000 acres were alfalfa, and about 15,000 acres were irrigated pasture grasses. About 8,000 acres were orchards and asparagus fields. Approximately 80,000 acres were double cropped with vegetables or melons followed by a small grain. Most of the remaining acreage was used for field crops including cotton, sugar beets, wheat, barley, and sorghum.

Almost all of the present irrigated acreage is served by Colorado River water by means of gravity canals and field head ditches. Irrigation is principally supplied by gravity surface methods.

In addition, about 400,000 acres within the survey area are desertland that has potential for irrigated farming. Most of this area is public domain or military reservations. Development of agriculture is restricted by lack of irrigation water, and the present allotment of Colorado River water for this area cannot be extended much further. Ground water supplies are limited, they recharge very slowly, and in many places are of poor quality. Unless the Colorado River flow is augmented from areas outside its watershed, or the costs of desalinized water drop tremendously, there is little prospect of extensive increase in irrigated acreage. Most of the desert areas are above the present gravity water delivery and would require pump systems. If these lands are developed for irrigated farming, many areas will need drainage.

Salinity control is the major soil management concern in the Imperial Valley Area. Soluble salts were present in most of the soils at the time the soils were deposited. More than a ton of salt is left in the land with every acre foot of irrigation water. If just enough water is added to replace evapotranspiration losses, the salts accumulate in the root zone until the soil is too saline for crop growth. Salinity is controlled by leaching or flushing the salts down through the soil below the root zone by means of generous irrigation or by ponding water on the soil surface. Effective leaching depends on good drainage. If a perched water table develops during leaching, the salts will be brought back up into the root zone by capillary water rising from the table.

Areas of good natural drainage are rare in the irrigated lands of Imperial Valley. Because of the stratified soils, vertical water movement is restricted and perched water tables develop under irrigation. These tables are controlled more effectively by lateral drains, such as tile or open ditches, than by pumping from wells. The optimum distance between drains is a function of soil permeability. Such fine textured soils as the Imperial soils are slowly permeable and need closely spaced drains. In soils with rapid permeability, such as the sandy Rositas soils, water tables can be controlled with widely spaced drains. The depth of drains is limited by the difficulty of maintaining gravity outlets, but the drain systems are designed to keep water tables below 4.5 feet to inhibit capillary rise to the soil surface. Open drains are effective, but take up space, divide land into small parcels, and require frequent maintenance. For these reasons tile systems are preferred for field drainage. A trunk system of open drains serves to carry tile discharge and irrigation waste water to the Salton Sea.

Irrigation water management is extremely important in this area. Good management can supply plant needs and flush salts from the root zone without excessive waste of a limited water supply. Knowledge of the soil's water intake rate is used to design proper field slope and length of irrigation run, or to select sprinkler application rates. For example, the Imperial silty clay has a slow water intake rate. For surface irrigation, fields on this soil should be leveled to a very gentle slope so that the water flows slowly over the surface and has time to sink into the soil before it reaches the far end of the field. Long irrigation runs, up to 1/2 mile in length, cause little reduction in irrigation efficiency. On soils with rapid water intake rates, such as Rositas fine sand, the water sinks into the soil so quickly that runs must be reduced to 300 feet or less for efficient surface irrigation.

Irrigation system design can be improved by knowledge of the water-holding capacity of soils. A soil with relatively low water-holding capacity, such as Rositas fine sand, should be irrigated every 3 to 4 days in hot months in summer avoid stress to certain crops, while the same crop on Indio loam could last more than a week without distress. Detailed recommendations for irrigation are given in the "Irrigation Guide for the Imperial Valley", U. S. Department of Agriculture, Soil Conservation Service.

Fertilization of crops and pasture depends partly on the soil properties and partly on crop requirements. In general, all crops except legumes must have their nitrogen requirements supplied by fertilizer. In the fine textured soils denitrification is rapid under the temporary anaerobic conditions in the soil following irrigation. In the sandy textured soils the nitrate ion is readily leached below plant roots. For these reasons split nitrogen applications, made at different times, are more efficiently utilized by plants than the same amount of nitrogen applied at one time. There is little carry-over of nitrogen fertilizer from the previous crop.

In all Imperial Valley soils, phosphorus applications in the form of superphosphate react rapidly with the free lime to form very weakly soluble calcium phosphate compounds. Many fields have a long history of phosphate fertilization, and many crops show little response to added phosphate on these fields. Phosphorus applied to row crops is most efficiently utilized when banded near the seed. Banding sulphuric acid near the plant row can lower the pH of a small volume of these moderately alkaline soils and make the phosphorus in this zone more available to plant roots.

Potassium is present in all soils in adequate amounts. Crops do not show a response to potassium fertilizers, even on sandy soils.

Fertilization recommendations for crops and pasture in the Imperial Valley are available from the University of California Agricultural Extension Service, Imperial County Court House, El Centro, California.

There are no known instances of trace nutrient deficiency or toxicity for the commonly grown crops on soils of this area. Slight yellowing of citrus leaves is noted in cool weather, but the symptoms clear up in the warmer months.

Soil amendments such as gypsum, sulphur, and sulphuric acid have no appreciable affect on these moderately alkaline, calcareous soils. Such fine textured soils as the Imperial series have slow permeability, but this is related to texture, not adsorbed sodium. The Imperial soils usually contain free gypsum. Acid amendments of sulphur or sulphuric acid will form more gypsum from the free lime in the soil, but acid would have to be applied in astronomical amounts to react with all the free lime, which buffers the pH near 8.

Barnyard manure is a plentiful by-product of the large cattle feeding industry in Imperial Valley. It is a valuable source of nitrogen, phosphorus, and organic matter. However, it does contain undesirable salt and weed seeds, but the salt additions from manure are small compared to the salts added by irrigation water. The relative cost of plant nutrients from manure versus the same nutrients from chemical fertilizer is the major factor in manure use on the land. The organic matter in manure is an added benefit, improving soil tilth, water intake, available water capacity, and base exchange capacity.

Soil erosion is not a serious concern in this area of low rainfall and nearly level soils, although limited areas next to the river bluffs and deep drains have a special hazard of erosion. Irrigation water escaping from fields next to deep channels can cause rapid piping or gulley erosion, trenching fields and cutting field roads and ditches (fig. 12). A special erosion control practice, the underground barrier, is used to prevent gopher tunnels from causing erosion along the edges of fields next to deep drains. The underground barrier is a thin concrete wall, poured in place by a slip form attached to a deep subsoil shank, and pulled through the soil by a heavy tractor.

Some fields along the desert edge are subject to damage by runoff from adjacent desert areas. Many areas are protected by storm dikes that divert the runoff to storm channels.

Wind erosion and soil blowing are serious problems mainly along the desert edges. Windblown sand from the desert fills ditches, covers crops, and alters field levels. Tamarisk or athel tree windbreaks are the usual means of coping with the problem. These trees are hardy, dense, salt-tolerant, fast growing, and easily propagated from cuttings. They should not be planted within 200 feet of tile drains because the roots grow into the tile lines and clog them. These trees are easily windthrown and should not be planted too close to structures that could be damaged by blown-down trees.

Use of crop residue as a means of improving soil organic matter is a controversial subject in this area. These desert soils are low in organic matter, and crop residues are a convenient source of organic matter which improves the tilth, porosity, and water intake rates of fine textured soils, such as the Imperial and Holtville soils. In sandy soils, such as the Rositas and Niland soils, organic matter improves the base exchange capacity and available water capacity.

Growers commonly burn straw and stubble with the belief that burning helps control weeds, insects, and disease. Growers also contend that crop residues tie up available nitrogen for some time after the residues are incorporated into the soil. The smoke from burning crop residues is a serious concern of air pollution authorities, who regulate agricultural burning. If growers can handle their pest control problems by other means than burning, they can benefit from the addition of organic matter in crop residues. Planting dates and fertilizer applications can be adjusted to compensate for the nitrogen tied up in decomposing crop residues.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations.

Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils for cropland. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIs-3 or IVe-5. The numbers used to designate units within the subclasses are as follows:

0.—Indicates that a problem or limitation is caused by stony, cobbly, or gravelly material in the substratum.

1.—Indicates that a problem or limitation is caused by slope or by actual or potential erosion hazard.

2.—Indicates that a problem or limitation of wetness is caused by poor drainage or flooding.

3.—Indicates that a problem or limitation of slow or very slow permeability of the subsoil or substratum is caused by a clayey subsoil or a substratum that is semiconsolidated.

4.—Indicates that a problem or limitation is caused by sandy or gravelly soils with a low available water-holding capacity.

5.—Indicates that a problem of limitation is caused by a fine textured or very fine textured surface layer.

6.—Indicates that a problem or limitation is caused by salt or alkali.

7.—Indicates that a problem or limitation is caused by rocks, stones, or cobblestones.

8.—Indicates that a problem or limitation exists in the root zone, which generally is less than 40 inches over massive bedrock and lacks moisture for plants.

9.—Indicates that a problem or limitation is caused by low or very low fertility, acidity, or toxicity that cannot be corrected by adding normal amounts of fertilizer, lime, or other amendments.

No unit designations are shown for class I soils since soil characteristics are similar for all soils in this class. Unit designations are also deleted from class VIII soils since these soils are not intensively managed for cropland.

Capability groupings are identified in the description of each soil mapping unit in the section "Soil maps for detailed planning".

The system of numbering units is statewide, and not all the units that have been established in the state are represented in this soil survey area.

Basic assumptions applied in grouping the soils of the area into capability classes, subclasses, and units are given in the following paragraphs.

The climate generally favors the development of intensive irrigated farming. Some temperature-inversion belts occur which are utilized for frost-sensitive winter crops. The relative frost hazard is not considered in this land classification.

It is also assumed that rainfall is insufficient to provide a sustained yield of native forage or crop plants without irrigation. Therefore, all soils unsuited for irrigation because of stoniness, permanent high water table, or steep slope are placed in Class VIII. Soils not presently irrigated are classified on the same basis as land under irrigation.

It is assumed that irrigation water is available to all irrigable land within the survey area either by diversion from the Colorado River or from wells. It is also recognized that this water has high salinity hazards and is toxic to some crops. This requires provision for drainage on nearly all irrigated lands within the survey area. The installation, operation, and maintenance of drainage facilities is considered a continuing problem, and is recognized in this land classification.

Flood damage is not considered a permanent limitation on use and management of the land, although in some cases flood control projects are needed to remove flood hazards. It is assumed that floods on the Colorado River have been effectively controlled.

It is also assumed that the level of management maintained can sustain the productive capacity of the soil resource and is within the practical ability of the majority of farmers in the area.

Storie index rating

Gordon L. Huntington, lecturer and soil specialist, Department of Land, Air and Water Resources, University of California, Davis, prepared this section.

The soils of the Imperial County Area are rated according to the Storie Index (*7, 8*). This index expresses numerically the relative degrees of suitability of a soil for general intensive agriculture as it exists at the time of evaluation. The rating is based on soil characteristics only, and is obtained by evaluating such factors as soil depth and permeability, surface texture, drainage, salinity, and relief. Factors not considered are availability of water for irrigation, climate, and distance from markets that might determine the desirability of growing certain plants in a given locality. Therefore, in itself, the index should not be considered as a direct indicator of land value. However, where economic factors are known to the user, the Storie index provides objective information for land tract value comparisons. In this report, the index rating is given at the end of each soil description.

Four general factors are considered in the index rating: (A) the characteristics of the soil profile and soil depth; (B) the texture of the surface soil; (C) the dominant slope of the soil body; and (X) other factors more readily subject to management or modification. In the Imperial County Area, the X factors include drainage, salinity, general nutrient level of the soil, erosion, and surface microrelief. For some soils, more than one of the latter conditions may be present and are included in the rating process. Each of the factors is evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable or ideal condition for general crop production; lower percentage ratings are assigned for conditions that are less favorable. Factor ratings are selected from tables prepared from data and observations that relate soil properties, plant growth, and crop yield (*9*). Where ranges of values exist for these factors in a given soil unit, the modal condition for each factor is used in assigning a percentage rating.

The index rating for a soil is obtained by multiplying the values assigned to the four factors, A, B, C, and X; thus any factor may dominate or control the final rating. For example, a soil unit such as Indio loam, wet, is a deep soil with a moderately permeable profile. This warrants a rating of 100 percent for factor A. The soil has a loam surface texture that is easily tilled, warranting a rating of 100 percent for factor B. A smooth, nearly level surface to the soil justifies 100 percent for factor C. Natural drainage altered by irrigation and seepage resulting in the development of shallow, perched water tables within the soil warrants a rating of 60 percent for factor X. Multiplying these four factors gives a Storie index of 60 for this soil. If the drainage problem can be effectively corrected, the Storie index can be revised upward by assigning an appropriate higher value to the X factor to reflect the improved drainage.

Rating of each of the map units in this area are for the dominant soil or soils within the unit as described and do not take into account smaller inclusions of other soils. Soil complexes (i.e. Holtville-Imperial silty clay loams) are rated to reflect the proportion of the dominant soils similarly to the way fields containing several different soil map units can be rated. The latter is done by summing and averaging Storie index value for the soil units present weighted by the acreages of the units in the field.

Soils are placed in six grades according to their suitability for general intensive farming as shown by their Storie index ratings. The grades and their range in index ratings are:

	Index rating
Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	less than 10

Soils of Grade 1 are excellent or well suited to general intensive farming. Grade 2 soils are good or also well suited to general farming, although they are not as desirable as soils in Grade 1. Grade 3 soils are only fairly well suited; Grade 4 soils are poorly suited; and Grade 5 soils are very poorly suited. Grade 6 consists of soils and land types that are not suited to farming.

Engineering

William D. Goddard, area engineer, Soil Conservation Service, helped to prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 5 shows, for each kind of soil, the degree and kind of limitations for building site development; table 6, for sanitary facilities; and table 8, for water management. Table 7 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 5. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 5 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 5 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load-supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density and shrink-swell potential are indicators of the traffic-supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 6 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones and soils susceptible to slumping when trenched interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel are less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 6 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from loamy or silty strata for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 7 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 11 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 7 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 11.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 8, soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 8 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 6, and interpretations for dwellings without basements and for local roads and streets, given in table 5.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the suitable soil layers over less suitable layers should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Richard McCabe, biologist, Soil Conservation Service, assisted in preparing this section.

Fish and wildlife provide opportunities for recreation and improve the quality of life in the Imperial Valley Area. They play an important role in the biological control of insect pests. They also provide a valuable role in outdoor recreation for hunters, fishermen, naturalists, and birdwatchers. The area covered by the soil survey is limited to cropland, wetland, and rangeland types of wildlife habitat. The kinds of wildlife are listed under the description of each type of habitat.

Warmwater fish including black bass, catfish, and sunfish inhabit the lakes, ponds, and canals within the survey area. Commercial fish farms for catfish and other warmwater species are a growing industry. The endangered bonytail, Colorado squawfish, and humpback sucker are present in the All American and Coachella Canals (*3*).

Other wildlife of particular interest are the mammals, reptiles, arthropods, and upland birds associated with the desert ecosystem. Rare or endangered wildlife associated with the waterfowl and shorebirds of the wetlands around the Salton Sea are the black rail and the Yuma clapper rail (*3*).

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, by irrigation, or by helping the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, ryegrass, lana vetch, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are sprangletop, little seed canarygrass, wild sunflower, mustard, and lambsquarter.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are honey mesquite, wingscale, creosotebush, and quailbush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and arrowweed and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include mourning dove, killdeer, ring-necked pheasant, California quail, jackrabbit, cottontail rabbit, and skunk.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, rails, terus, muskrat, raccoons, and bullfrogs.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include bobcat, brush rabbit, coyote, desert kit fox, desert mule deer, kangaroo rat, roadrunner, and quail.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for some soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 11 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 11 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 11 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 11. Also in table 11 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 12 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

The available water capacity is usually approximated by laboratory methods that measure the water held in crushed, seived soil samples at tensions between 1/10 bar and 15 bars for sand and loamy sand, or between 1/3 bar and 15 bars for textures finer than loamy sand. Studies have shown that water in the stratified soils of Imperial Valley is usually at tensions between 1/20 and 1/10 bar for periods up to 3 days after irrigation (*5*). This has little effect on total available water capacity for fine textured soils, but loam and silt loam soils of this area have their available water capacity approximately doubled when 1/10 bar moisture is used to estimate available water capacity. The available water capacity of sands is approximately doubled when 1/20 bar moisture is used in the estimate.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 12. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building slabs and foundations, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if disturbed. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 13 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 13 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*14*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

Antho series

The Antho series consists of very deep, well drained soils that formed in alluvial deposits in basins of the lower Colorado River area. Elevation is 40 to 350 feet. Slopes are 0 to 2 percent. The natural vegetation is creosotebush, white bursage, ephedra, and ephemeral herbs and grasses.

Antho soils are similar to the Glenbar, Holtville, Indio, Laveen, Meloland, Niland, Rositas, Superstition, and Vint soils. Glenbar soils have a fine-silty control section. Holtville soils have clayey material over loamy material. Indio soils have a coarse-silty control section. Laveen and Superstition soils have a calcic horizon. Meloland soils have a coarse-loamy over clayey control section, and Niland soils have a sandy over clayey control section. Vint, Rositas, and Superstition soils are sandy in the control section.

Typical pedon of Antho loamy fine sand, 1/4 mile south of the northeast corner of sec. 19, T. 14 S., R. 18 E.

C1—0 to 13 inches; reddish yellow (7.5YR 7/6) loamy fine sand, reddish yellow (7.5YR 6/6) moist; single grain; loose; few very fine, fine, and medium roots; few fine tubular pores; few large irregularly shaped soft lime masses; violently effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

C2—13 to 19 inches; reddish yellow (5YR 6/6) fine sandy loam, reddish brown (5YR 5/4) moist; weak coarse subangular blocky structure; hard, friable, nonsticky and slightly plastic; many very fine roots; few very fine tubular pores; common medium concretions and soft masses of lime; violently effervescent; moderately alkaline (pH 8.0); clear wavy boundary.

C3—19 to 23 inches; reddish yellow (7.5YR 7/6) loamy very fine sand, strong brown (7.5YR 5/6) moist; massive; slightly hard, very friable; few fine and very fine roots; common fine and very fine tubular pores; violently effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

C4—23 to 27 inches; reddish yellow (7.5YR 7/6) very fine sandy loam, yellowish red (5YR 5/6) moist; weak coarse subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; common very fine tubular pores; few medium concretions and soft masses of lime; violently effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

C5—27 to 42 inches; pink (7.5YR 7/4) loamy very fine sand, brown (7.5YR 5/4) moist; massive; slightly hard, friable; few very fine, fine, and medium roots; few fine tubular pores; violently effervescent; moderately alkaline (pH 8.0); abrupt irregular boundary.

IIC6—42 to 44 inches; strong brown (7.5YR 5/6) sandy clay, brown (7.5YR 5/4) moist; weak coarse subangular blocky structure; hard, firm, sticky and plastic; many fine and very fine roots in cracks and fracture planes; few fine tubular pores; many large black stains and few fine yellow mottles in cracks and in pores; violently effervescent; moderately alkaline (pH 8.0); abrupt irregular boundary.

IIIC7—44 to 50 inches; reddish yellow (7.5YR 7/6) loamy very fine sand, strong brown (7.5YR 5/6) moist; massive; slightly hard, very friable; few fine roots; few medium and common fine and very fine tubular pores; segregated lime in cracks and pores; violently effervescent; moderately alkaline (pH 8.0); abrupt wavy boundary.

IVC8—50 to 54 inches; light reddish brown (5YR 6/4) silty clay, reddish brown (5YR 5/4) moist; weak coarse subangular blocky structure; hard, very firm, very sticky and very plastic; few very fine roots; common very fine interstitial pores; many large black stains on surfaces of cracks and fractures; few large concretions and soft masses of lime; violently effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

VC9—54 to 60 inches; pink (7.5YR 7/4) very fine sandy loam, brown (7.5YR 5/4) moist; massive; hard, very friable, nonsticky and slightly plastic; very few very fine roots; few very fine tubular pores; many medium soft masses of segregated lime in cracks; violently effervescent; moderately alkaline (pH 8.0).

Segregated soft masses and concretions of lime make up 1 to 4 percent of the volume of some layers within a depth of 40 inches. Most pedons are nonsaline or slightly saline, but some are strongly saline.

The C1 horizon ranges in thickness from 8 to 13 inches. It has a thin vesicular crust in some areas. Hue ranges from 7.5YR to 10YR, value is 6 or 7, and chroma ranges from 3 to 6. The 10- to 40-inch control zone has the same color ranges as the C1 horizon, or has a hue of 5YR. This depth zone in most pedons is dominantly stratified, with loamy very fine sand and fine sandy loam; however, some pedons have contrasting sandy, loamy, or clayey layers less than 6 inches thick. Average texture of the 10- to 40-inch control zone is less than 18 percent clay and between 15 to 70 percent fine sand and coarser sand.

Antho soils in this survey area have soft masses and concretions of segregated lime in some layers within a depth of 40 inches. They also have chroma of more than 4, thin lenses of clay, and salinity in some pedons. Because of this, the soils are outside the range defined for the Antho soils. These differences, however, do not significantly affect the use and management of these soils.

Carsitas series

The Carsitas series consists of very deep, excessively drained soils that formed in alluvial deposits of granitic and metamorphic origin on alluvial fans, beach ridges, and drainageways (fig. 13). Elevation is 200 feet above sea level to 230 feet below. Slopes are 0 to 5 percent. The natural vegetation is scattered shrubs of wingscale, creosotebush, bursage, and ocotillo, with mesquite, paloverde, and smoketree in the drainageways.

Carsitas soils are similar to and near the Niland, Rositas, Superstition, and Vint soils. They are also near the Holtville, Imperial, Indio, and Meloland soils. Holtville, Imperial, Meloland, and Niland soils have prominent clayey layers at a depth between 10 and 40 inches. Rositas and Vint soils contain less than 15 percent gravel. Superstition soils have a calcic horizon.

Typical pedon of Carsitas gravelly sand, 0 to 5 percent slopes, 650 feet south and 130 feet west of the northeast corner of sec. 21, T. 10 S., R. 14 E.

C1—0 to 10 inches; pink (7.5YR 8/4) gravelly sand, pinkish gray (7.5YR 7/2) moist; massive; soft, very friable; few fine and medium tubular and many fine interstitial pores; 25 percent gravel; slightly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C2—10 to 15 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; many fine interstitial pores; 5 percent gravel; slightly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C3—15 to 19 inches; very pale brown (10YR 7/3) coarse sand, pale brown (10YR 6/3) moist; massive; soft, very friable; many fine interstitial pores; 10 percent gravel; slightly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C4—19 to 24 inches; very pale brown (10YR 7/4) gravelly sand, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; many fine interstitial pores; 30 percent gravel; slightly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

C5—24 to 38 inches; very pale brown (10YR 7/3) gravelly coarse sand, pale brown (10YR 6/3) moist; single grain; loose; many fine interstitial pores; 15 percent gravel; slightly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C6—38 to 44 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; massive; hard, very friable; many fine interstitial pores; 10 percent gravel by volume; few lime concretions; slightly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C7—44 to 68 inches; very pale brown (10YR 7/3) sand, brown (10YR 5/3) moist; massive; slightly hard, very friable; many fine interstitial pores; 5 percent gravel; slightly effervescent; moderately alkaline (pH 8.2).

A desert pavement covers some areas. All layers are calcareous, but most pedons lack segregated lime. Depth to contrasting, fine textured alluvium is more than 40 inches and generally more than 60 inches.

The C1 horizon ranges in thickness from 1 to 18 inches. Hue ranges from 7.5YR to 10YR, value from 6 to 8, and chroma is 3 or 4.

The control section is sandy in all parts and averages 15 to 35 percent rock fragments, which include cobbles and stones.

Glenbar series

The Glenbar series consists of very deep, well drained soils that formed in alluvial deposits on flood plains and basin floors. Elevation is 200 feet above sea level to 230 feet below. Slopes are 0 to 5 percent. The natural vegetation is a sparse shrub growth of quailbush and cattle spinach, with iodine weed and pickleweed in the more saline areas, and saltcedar and arrowweed where ground water levels are high.

Glenbar soils are similar to Holtville, Imperial, Indio, and Meloland soils. They are near the Holtville, Imperial, Indio, Meloland, Niland, Rositas, and Vint soils. Holtville soils have a clayey over loamy control section. Imperial soils are clayey throughout. Indio soils have a coarse-silty control section. Meloland soils have a coarse-loamy over clayey control section. Niland soils have a sandy over clayey control section. Rositas and Vint soils have a sandy control section.

Typical pedon of Glenbar clay loam, wet, approximately 650 feet north and 50 feet west of gate 30-A, Ohmar Lateral Canal, in NE1/4SE1/4 sec. 6, T. 14 S., R. 15 E.

Ap—0 to 13 inches; pinkish gray (7.5YR 6/2) clay loam, brown (7.5YR 5/2) moist; massive; very hard, friable, slightly sticky and plastic; many medium and coarse roots and common fine roots; few medium tubular pores; strongly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

C1—13 to 23 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; massive; hard, friable, slightly sticky and plastic; common fine and medium roots; few fine and medium tubular pores; violently effervescent; moderately alkaline (pH 8.0); clear wavy boundary.

C2—23 to 36 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 4/2) moist; massive; hard, friable, sticky and plastic; common fine roots; common fine rust-stained pores; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

C3—36 to 53 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/2) moist; massive; very hard, firm, sticky and very plastic; few very fine roots; few very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0); gradual wavy boundary.

C4—53 to 60 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/2) moist; massive; very hard, firm, sticky and very plastic; few very fine roots; few very fine pores; strongly effervescent; moderately alkaline (pH 8.0).

All layers are calcareous and have disseminated lime. These soils are mildly alkaline to strongly alkaline, and are nonsaline or slightly saline. The horizons have hue of 10YR or 7.5YR, value of 6 or 7, and chroma of 2 to 4. Moist colors are 1 or 2 units darker.

The control section has strata of silty clay loam, clay loam, sandy clay loam, and silt loam. Sand coarser than very fine sand averages less than 15 percent in this zone. In some pedons there are contrasting textures below a depth of 40 inches. Some pedons have gypsum efflorescences in the control section.

Holtville series

The Holtville series consists of very deep, well drained, stratified soils that formed in mixed alluvial deposits on flood plains, terraces, and basin floors. Elevation is 200 feet above sea level to 230 feet below. Slopes are 0 to 2 percent. The natural vegetation is a sparse growth of quailbush, creosotebush, and mesquite.

Holtville soils are similar to Glenbar, Imperial, and Meloland soils. They are near Glenbar, Imperial, Indio, Meloland, Niland, Rositas, and Vint soils. Glenbar soils have a fine-silty control section. Imperial soils are clayey throughout the control section. Meloland soils have a coarse-loamy over clayey contol section. Niland soils have a sandy over clayey control section. Rositas and Vint soils are sandy in the control section.

Typical pedon of Holtville silty clay, wet (natural drainage altered by seepage), 550 feet north of the south edge of the field and 210 feet west of the ditch on the east side in the south half of Tract 130, T. 13 S., R. 13 E.

Ap—0 to 17 inches; light brown (7.5YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; massive; hard, very firm, sticky and plastic; common very fine and few fine roots; few very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

C1—17 to 24 inches; light brown (7.5YR 6/4) silty clay, brown (7.5YR 5/4) moist; moderate medium platy structure; hard, firm, very sticky and very plastic; few fine roots; common very fine tubular pores; vertical cracks about 2 inches wide at top and 12 to 18 inches apart filled with loamy fine sand; strongly effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

IIC2—24 to 35 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; discontinuous, thin stratum of silty clay at a depth of 27 inches; strongly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.

IIIC3—35 to 72 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; single grain; loose; few very fine interstitial pores; discontinuous, thin stratum of silty clay at a depth of 37 inches; strongly effervescent; moderately alkaline (pH 8.0).

Some pedons have soft threads and masses of gypsum. Reaction of some pedons is mildly alkaline. Hue ranges from 5YR to 10YR, value from 5 to 7, and chroma from 2 to 4. Moist colors are 1 to 2 value units darker.

The Ap horizon is loam, silty clay loam, or silty clay, and ranges in thickness from 10 to 17 inches.

The upper part of the control section is silty clay or clay. The lower part is loamy fine sand, loamy very fine sand, or silt loam. Vertical tongues, 1/2 to 2 inches wide, of loamy fine sand or coarser material fill old cracks in some pedons. Below a depth of 40 inches, strata range from clay to sand.

In map units 108—Holtville loam and 111—Holtville-Imperial silty clay loams, the Holtville soil contains about 3 percent soft masses and concretions of lime in the surface horizon. This difference, however, does not significantly affect use and management of the soil.

Imperial series

The Imperial series consists of very deep, moderately well drained soils that formed in recent alluvial deposits on flood plains and basins. Elevation is 200 feet above sea level to 230 feet below. Slopes are 0 to 2 percent. The natural vegetation is a sparse growth of quailbush, creosotebush, inkweed, and pickleweed.

Imperial soils are similar to and are near the Glenbar, Holtville, Meloland, and Niland soils. They are also near the Rositas and Vint soils. Glenbar soils have a fine-silty control section. Holtville soils have a clayey over loamy control section. Meloland soils have a coarse-loamy over clayey control section. Niland soils have a sandy over clayey control section. Rositas and Vint soils are sandy throughout.

Typical pedon of Imperial silty clay, 0 to 2 percent slopes, on bluff of New River at north edge of NW1/4NW1/4 sec. 15, T. 13 S., R. 14. E.

C1—0 to 4 inches; pinkish gray (7.5YR 6/2) silty clay, brown (10YR 4/3) moist; weak, thin platy structure; slightly hard, firm, sticky and slightly plastic; strongly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C2—4 to 12 inches; light brown (7.5YR 6/4) silty clay, brown (7.5YR 5/4) moist; moderate medium platy structure; hard, very firm, sticky and plastic; few fine roots; few fine tubular pores; few fine gypsum efflorescences; strongly effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

C3—12 to 60 inches; pinkish gray (7.5YR 6/2) silty clay, brown (7.5YR 5/4) moist; strong, very thick platy structure; extremely hard, very firm, sticky and plastic; yellowish red stains (5YR 5/6), reddish brown (5YR 4/4) moist on faces of cracks below a depth of 55 inches; strongly effervescent; moderately alkaline (pH 8.1).

All soil layers contain disseminated lime and are moderately alkaline or strongly alkaline. Many pedons have gypsum efflorescences in cracks and pores. The soil ranges from nonsaline to strongly saline. Hue ranges from 5YR to 10YR, value from 5 to 7, and chroma from 2 to 4. Moist colors are 1 to 2 value units darker. Vertical cracks in the dry soil extend to a depth of 3 feet or more and are commonly 1/2 inch wide at a 20-inch depth. In some places cracks are filled with windblown silt and fine sand. Very thin strata of silt or very fine sand are present in layers not mixed by cultivation.

The C1 horizon is silty clay or silty clay loam and ranges in thickness from 4 to 18 inches. The layers from 10 to 40 inches in depth are clay, silty clay, or heavy silty clay loam. Faces of some cracks and old root channels have stains of yellowish red or brownish yellow.

In map unit 111—Holtville-Imperial silty clay loams, the Imperial soils have 7 to 10 percent segregated lime in the surface layer to a depth of 20 inches. This characteristic is outside the range for the series but does not significantly affect the use and management of the soils.

Indio series

The Indio series consists of very deep, well drained soils that formed in recent mixed alluvial or eolian material on flood plains and basins. Elevation is 200 feet above sea level to 230 feet below. Slopes are 0 to 2 percent. The natural vegetation is scattered creosotebush, bursage, and wingscale.

Indio soils are similar to the Antho, Glenbar, Laveen, Meloland, and Vint soils. They are near the Glenbar, Holtville, Imperial, Meloland, Niland, Rositas, and Vint soils. Antho soils have a coarse-silty control section and distinct lime segregations. Glenbar soils have a fine silty control section. Imperial soils have a fine control section. Holtville and Meloland soils are stratified with contrasting clayey and loamy textures in the control section. Laveen soils have a calcic horizon and have a coarse-loamy control section. Niland soils have a sandy over clayey control section. Rositas and Vint soils are sandy throughout.

Typical pedon of Indio loam, west of Wulf's Crossing and south of the New River, 850 feet east, 400 feet north of gate 123, Wisteria Lateral 8, near center of NE1/4NE1/4 sec. 29, T. 16 S., R. 13 E.

Ap—0 to 12 inches; pinkish gray (7.5YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; few very fine pores; strongly effervescent; moderately alkaline (pH 8.2); abrupt wavy boundary.

C1—12 to 30 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; few very fine roots; thin cross-bedded microstrata; few fine distinct rust stains on faces of cracks; strongly effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.

C2—30 to 44 inches; pink (7.5YR 7/4) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; few very fine roots; few very fine pores; thin cross-bedded microstrata; few large strong brown

(7.5YR 5/6) moist stains in cracks; strongly effervescent; moderately alkaline (pH 8.2); diffuse wavy boundary.

C3—44 to 58 inches; pink (7.5YR 7/4) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; few very fine roots; common very fine and fine continuous pores lined with organic matter; thin cross-bedded microstrata; strongly effervescent; moderately alkaline (pH 8.2); diffuse wavy boundary.

C4—58 to 72 inches; pink (7.5YR 7/4) loamy very fine sand, pale brown (10YR 6/3) moist; massive; soft, very friable; few very fine roots; few very fine pores; thin cross-bedded strata; strongly effervescent; moderately alkaline (pH 8.2).

All layers contain disseminated lime and are moderately alkaline or strongly alkaline. Some pedons contain neutral salts. Hue ranges from 5YR to 10YR, value from 5 to 7, and chroma from 2 to 4. Moist colors are 1 to 3 value units darker. The texture of the control section is silt loam, loam, very fine sandy loam, or loamy very fine sand. The control section of some pedons has thin strata of contrasting textures. Some cracks and bedding planes have yellowish red or strong brown stains.

Laveen series

The Laveen series consists of very deep, well drained soils that formed in mixed alluvium on old alluvial fans and terraces (fig. 14). Elevation is 40 to 350 feet. Slopes are 0 to 3 percent. The natural vegetation is a very sparse scattering of desert ephemerals, with a few creosotebush plants in the drainageways.

Laveen soils are similar to the Antho, Glenbar, and Vint soils. They are near the Antho, Rositas, Superstition, and Vint soils. Antho, Glenbar, and Indio soils do not have a calcic horizon. Also, Glenbar soils have a fine-silty control section. Rositas, Superstition, and Vint soils are sandy throughout. The Rositas and Vint soils do not have a calcic horizon.

Typical pedon of Laveen loam, 1,150 feet south and 800 feet west of the northeast corner of sec. 27, T. 15 S., R. 10 E.

A1—0 to 2 inches; pink (7.5YR 7/4) loamy very fine sand, reddish yellow (7.5YR 6/6) moist; massive; soft, very friable; many fine vesicular pores; strongly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C1ca—2 to 12 inches; reddish yellow (7.5YR 6/6) loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; hard, friable, sticky and slightly plastic; common interstitial pores; 3 percent gravel; free salt crystals; 5 percent soft lime segregations; violently effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

C2ca—12 to 18 inches; reddish yellow (7.5YR 6/6) loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; hard, friable, sticky and slightly plastic; common fine interstitial pores; few salt crystals; 10 percent soft lime segregations; violently effervescent; moderately alkaline (pH 8.4); clear wavy boundary.

C3ca—18 to 28 inches; light yellowish brown (10R 6/4) very fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; common fine tubular pores; strongly saline; 10 percent soft lime segregations; violently effervescent; moderately alkaline (pH 8.2); gradual smooth boundary.

C4—28 to 60 inches; very pale brown (10YR 7/4) very fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; nonsticky and nonplastic; common fine tubular pores; moderately saline; few fine soft lime segregations; strongly effervescent; moderately alkaline (pH 8.2).

Depth to the calcic horizon ranges from 2 to 10 inches. Lime content diminishes with depth to 10 percent or less. The soils are strongly saline in many areas, although salinity is not a property of the series. A desert pavement covers many areas. Hue ranges from 7.5YR to 10YR, value is 6 to 7, and chroma ranges from 3 to 6.

The control section is sandy clay loam, loam, or very fine sandy loam. Gravel content averages less than 15 percent.

The Laveen soils in this survey area differ from the defined characteristics of this series by having lime accumulations at a shallower depth. Some pedons have thin strata of more than 18 percent clay in the control section. This difference, however, does not significantly affect the use and management of these soils.

Meloland series

The Meloland series consists of very deep, well drained, stratified soils that formed in recent mixed alluvium on flood plains and alluvial basin floors (fig. 15). Elevation is 200 feet above sea level to 230 feet below. Slopes are 0 to 2 percent. The natural vegetation is a sparse shrub growth of creosotebush, bursage, wingscale, and mesquite.

Meloland soils are similar to Antho, Holtville, Indio, Laveen, and Niland soils. They are near the Glenbar, Holtville, Imperial, Indio, Niland, Rositas, and Vint soils. Antho, Indio, and Laveen soils do not have thick clayey strata in the control section. Laveen soils have a calcic horizon. Glenbar soils have a fine-silty control section. Holtville soils have a clayey over loamy control section. Imperial soils have a clayey control section. Niland soils have a sandy over clayey control section. Rositas and Vint soils are sandy throughout.

Typical pedon of Meloland very fine sandy loam, wet, 125 feet west of waste ditch and 115 feet south of field road in Tract 93 (near northeast corner), in the SE1/4SE1/4 of sec. 16 T. 13 S., R. 14 E.

Ap—0 to 12 inches; light brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable, slightly sticky and plastic; common fine roots; violently effervescent; mildly alkaline (pH 7.8); abrupt smooth boundary.
C1—12 to 18 inches; very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; massive; soft, very friable; few fine roots; some cross-bedding with yellowish brown (10YR 5/4) streaks; violently effervescent; mildly alkaline (pH 7.8); abrupt wavy boundary.
IIC2—18 to 26 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and plastic; few fine roots; common very fine and fine tubular pores; violently effervescent; mildly alkaline (pH 7.8); abrupt wavy boundary.
IIIC3—26 to 38 inches; pink (7.5YR 7/4) silty clay, brown (7.5YR 5/4) moist; moderate medium and thin platy structure; hard, firm, very sticky and very plastic; few fine roots; few very fine tubular pores; common fine gypsum efflorescences; strongly effervescent; mildly alkaline (pH 7.8); gradual smooth boundary.
IIIC4—38 to 71 inches; pink (7.5YR 7/4) silty clay, dark brown (7.5YR 4/4) moist; moderate thick platy structure; hard, firm, very sticky and very plastic; few very fine roots; very few fine tubular pores; faces of cracks covered with gypsum efflorescences to a depth of 59 inches; cracks contain common medium rust stains below a depth of 59 inches; strongly effervescent; mildly alkaline (pH 7.8).

Depth to the fine-textured stratum ranges from 16 to 36 inches. All layers are calcareous, mildly alkaline or moderately alkaline, and nonsaline to strongly saline. Hue is 7.5YR or 10YR, value is 6 or 7, and chroma is 3 to 5. Moist colors are 1 or 2 value units darker. Some strata of contrasting texture are below the surface layer.

The surface layer is fine sand, very fine sandy loam, or loam. The upper part of the control section averages less than 18 percent clay and contains between 15 and 70 percent fine sand and sand. Very fine sandy loam, loamy fine sand, and silt loam are most common. The lower part of the control section has strata of silty clay or heavy silty clay loam and extends to a depth of 40 inches or more.

Niland series

The Niland series consists of very deep, moderately well drained, stratified soils that formed in mixed alluvium on the edges of flood plains and alluvial basins. Elevation is 200 feet above sea level to 230 feet below. Slopes are 0 to 2 percent. The natural vegetation is a sparse shrub growth of creosotebush, bursage, wingscale, and mesquite.

Niland soils are similar to and near Carsitas, Imperial, Meloland, Rositas, and Vint soils. Carsitas soils are gravelly throughout the control section. Imperial soils are clayey throughout. Meloland soils have a coarse-loamy over clayey control section. Rositas and Vint soils are sandy throughout.

Typical pedon of Niland gravelly sand, wet, about 2 miles north of Niland on the north bank of "Z" Drain, 500 feet east of power line near the center of the south edge of sec. 20, T. 10 S., R. 14 E.

C1—0 to 23 inches; very pale brown (10YR 7/4) gravelly sand, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable; common very fine roots; strongly effervescent; moderately alkaline (pH 8.0); abrupt smooth boundary.
IIC2—23 to 60 inches; pale brown (10YR 6/3) silty clay, dark brown (10YR 4/3) moist; weak thick platy structure; extremely hard, firm, sticky and plastic; very few fine roots on faces of peds; few fine tubular pores; strongly effervescent; moderately alkaline (pH 8.3).

Depth to contrasting fine-textured strata ranges from 14 to 36 inches. The soils are mildly alkaline or moderately alkaline. The upper part of the pedon has from 5 to 20 percent rock fragments. Some pedons have stones and cobbles. Hue is 7.5YR or 10YR, value is 6 or 7, and chroma is 2 to 4. Moist colors are 1 or 2 value units darker.

Texture of the C1 horizon is gravelly sand, fine sand, or loamy fine sand. Stratification of these textures is common. The C2 horizon is clay, silty clay, or heavy clay loam. It is nonsaline to strongly saline. Vertical cracks in the lower strata are commonly filled with sandy materials, and some faces of cracks have yellowish red stains. In some pedons there are thin strata of contrasting textures within the fine textured material.

In map unit 127—Niland loamy fine sand, the Niland soil contains from 7 to 10 percent soft masses and concretions of lime below a depth of 36 inches. This difference, however, does not significantly affect the use and management of the soil.

Rositas series

The Rositas series consists of very deep, somewhat excessively drained soils that formed in alluvial or eolian sands on flood plains, basins, terraces, and sandhills. Elevation is 300 feet above sea level to 230 feet below. Slopes are 0 to 30 percent. The natural vegetation is shrub growth of creosotebush, bursage, wingscale, desert buckwheat, ephedra, and mesquite.

Rositas soils are similar to and near the Antho, Carsitas, Laveen, Meloland, Niland, Superstition, and Vint soils. They are also near the Glenbar, Holtville, Imperial, and Indio soils. Antho and Laveen soils have a coarse-loamy control section, and in addition, the Laveen soil has a calcic horizon. Carsitas soils are gravelly in the control section. Holtville, Meloland, and Niland soils are stratified, with clayey strata in the control section. Glenbar soils have a fine silty control section, and Imperial soils are clayey. Indio soils have a coarse-silty control section. Superstition soils have a calcic horizon. Vint soils have lenses finer than loamy fine sand in the control section.

Typical pedon of Rositas fine sand, 200 yards south of Evan Hewes Road (old U.S. 80), 0.8 mile west of main entrance of East Mesa Experimental Farm No. 2, in NW1/4 sec. 5, T. 17 S., R. 19 E.

C1—0 to 9 inches; reddish yellow (7.5YR 7/6) fine sand, strong brown (7.5YR 5/6) moist; single grain; loose; common fine and medium roots; strongly effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

C2—9 to 60 inches; reddish yellow (7.5YR 7/6) fine sand, strong brown (7.5YR 5/6) moist; single grain; loose; few fine roots; strongly effervescent; moderately alkaline (pH 8.0).

Topography is dominantly low dune but ranges from nearly level to high dune. Depth to material finer than loamy fine sand is more than 40 inches. Hue is 7.5YR and 10YR, value is 6 to 8, and chroma is 4 to 6. Cross-bedding is common.

Texture of the control section is loamy fine sand, fine sand, or sand.

In map units 136—Rositas loamy fine sand, 0 to 2 percent slopes, and 138—Rositas-Superstition loamy fine sand, the Rositas soil contains about 1 to 2 percent soft masses and concretions of lime in the surface layer. This difference, however, does not significantly affect the use and management of the soil.

Superstition series

The Superstition series consists of very deep, somewhat excessively drained soils that formed in sandy alluvial or eolian deposits from mixed sources on old terraces and alluvial fans. Elevation is 40 to 300 feet. Slopes are 0 to 2 percent. The natural vegetation is scattered creosotebush; ephemerals of the Plantago, Cryptantha, and Oenothera genera; and some white bursage and ephedra.

Superstition soils are similar to and are near the Carsitas, Laveen, Rositas, and Vint soils. They are also near the Antho and Holtville soils. Antho and Laveen soils are coarse-loamy in the control section, and the Holtville soils are stratified with clay over loam in the control section. Antho, Carsitas, Holtville, Rositas, and Vint soils do not have a calcic horizon.

Typical pedon of Superstition loamy fine sand, 250 feet north of the centerline of Evan Hewes Highway, from a point 1/4 mile northwest of the southeast corner of sec. 29, T. 16 S., R. 18 E.

A1—0 to 6 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; massive; soft, very friable; many very fine and fine roots; common fine tubular pores; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

C1ca—6 to 17 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable; many very fine and fine roots; common fine tubular pores; 2 to 5 percent gravel; common soft masses and concretions of lime; violently effervescent; moderately alkaline (pH 8.2); clear wavy boundary.

C2ca—17 to 25 inches; pink (7.5YR 8/4) sand, reddish yellow (7.5YR 7/6) moist; massive; soft, very friable; many very fine and fine roots; common fine tubular and interstitial pores; 1 to 3 percent gravel; few soft masses of lime; strongly effervescent; moderately alkaline (pH 8.2); gradual smooth boundary.

C3ca—25 to 36 inches; pink (7.5YR 8/4) sand, reddish yellow (7.5YR 7/6) moist; massive; soft, very friable; common very fine and fine roots; few fine tubular and common fine interstitial pores; 1 to 3 percent gravel; soft masses of lime mainly on the bottom of pebbles; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

C4—36 to 60 inches; pinkish white (7.5YR 8/2) sand, very pale brown (10YR 7/3) moist; single grain; loose; few very fine and fine roots; many fine interstitial pores; slightly effervescent; moderately alkaline (pH 8.2).

In some parts of the profile soft masses and concretions of lime range from 5 to 25 percent by volume. Lime segregations diminish with depth, and clean sand underlies most areas at a depth of 24 to 60 inches.

The surface of most pedons has a desert pavement of lime nodules and rounded gravel. A thin vesicular crust is common.

The control section has textures ranging from loamy fine sand to sand. Some pedons have clay lenses and strata of constrasting texture in the control section. Unconsolidated sediment makes up the stratum below a depth of 40 inches.

Vint series

The Vint series consists of very deep, well drained soils that formed in mixed alluvial or eolian materials on flood plains and alluvial basins. Elevation is 250 feet above sea level to 230 feet below. Slopes are 0 to 2 percent. The natural vegetation is a sparse shrub cover of wingscale, mesquite, creosotebush, and bursage.

Vint soils are similar to and near the Antho, Indio, Laveen, Rositas, and Superstition soils. Vint soils are also near the Glenbar, Holtville, Imperial, Meloland, and Niland soils. Antho, Glenbar, Indio, and Laveen soils are loamy in the control section. Antho and Laveen soils have segregated lime. Holtville, Meloland, and Niland soils contain clayey strata in the control section. Imperial soils are clayey throughout the control section. Rositas soils do not have lenses finer than loamy fine sand in the control section. Superstition soils have a calcic horizon.

Typical pedon of Vint loamy very fine sand, wet, 280 feet south of waste box at northwest corner of field and 150 east of center of Miller Road in the SW1/4NE1/4SE1/4 sec. 3, T. 16 S., R. 16 E.

Ap—0 to 10 inches; light brown (7.5YR 6/4) loamy very fine sand, brown (7.5YR 4/4) moist; massive; soft, very friable; few coarse and medium roots and common fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C1—10 to 16 inches; pink (7.5YR 7/4) loamy fine sand, brown (7.5YR 4/4) moist; massive; soft, very friable; few medium and common very fine roots; common fine tubular pores; strongly effervescent; moderately alkaline (pH 8.2); clear smooth boundary.

C2—16 to 38 inches; pink (7.5YR 7/4) loamy fine sand, brown (7.5YR 4/4) moist; massive; soft, very friable; many very fine roots; few very fine tubular pores; thin discontinuous pinkish gray clay loam lenses 2 to 4 inches apart, slightly cross-bedded; strongly effervescent; moderately alkaline (pH 8.2); abrupt smooth boundary.

C3—38 to 60 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; many very fine roots; few very fine pores; strongly effervescent; moderately alkaline (pH 8.2).

A contrasting fine textured layer is at a depth of more than 40 inches. Disseminated lime is present in most pedons. Hue ranges from 7.5YR to 10YR, value is 6 or 7, and chroma is 3 or 4.

The control section has average texture of loamy fine sand or fine sand and contains thin lenses of loam.

Color value of 7 is higher than that given in the range of characteristics for the Vint series. This difference, however, does not significantly affect use and management of the soils.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*15*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 14, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Psamment (*Psamm*, meaning sand, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Torripsamments (*Torri*, meaning dry with hot summers, plus *psamment*, the suborder of Entisols that are sandy in parts of the profile section).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Torripsamments.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is mixed, hyperthermic, Typic Torripsamments.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

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Glossary

Acre-foot. The quantity of water that will cover one acre to a depth of one foot.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material formed by a stream where it flows into a level plain or where its gradient decreases abruptly.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.5
Low	2.5 to 5
Moderate	5 to 7.5
High	7.5 to 10
Very high	More than 10

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Basin, topographic. A low area, commonly an area of deposition of sediments from surrounding uplands.

Beach ridge. A deposit of sand, gravel, and pebbles formed at the edge of a body of water by wave action.

Bearing strength, soil. The capacity of a soil to support loads without compresssing, shearing, or flowing.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Calcic horizon. A soil horizon enriched with secondary carbonates that is more than 6 inches thick, has a carbonate equivalent of more than 15 percent, and has at least 5 percent more calcium carbonate equivalent than the underlying C horizon.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Delta. An alluvial deposit, commonly triangular in shape, formed largely beneath water and deposited at the mouth of a river or stream.

Denitrification. The biological reduction of nitrate or nitrite to gaseous nitrogen either as molecular nitrogen or as an oxide of nitrogen.

Desert pavement. A layer of gravel or stones that remains on the ground surface after fine particles are removed by wind.

Desert varnish. Brown or black surface stains or crust of manganese or iron oxides, usually with a luster.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Dune. A mound or ridge of loose sand piled up by the wind.

Efflorescences. Powdery deposits of minerals resulting from evaporation or chemical change.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral vegetation. Plants capable of completing their growth cycle during brief periods of favorable moisture and temperature.

Erosion, hazard of. The relative rate at which water can wear away the surface of the soil as determined by the characteristics of the soil profile, slope, climate, and cover. In this report, erosion hazard is assumed under bare soil conditions.

Escarpment. An abrupt change in elevation of a landscape along a linear front.

Evapotranspiration. The combined loss of water from a given area by evaporation from the soil surface and by transpiration of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gypsic horizon. A soil horizon of secondary calcium sulfate enrichment that is more than 6 inches thick, and has at least 5 percent more gypsum than the C horizon.

Gypsum. Hydrous calcium sulphate.

Heavy textured soil. Silty clay and clay.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed from the cooling and solidification of molten mineral material.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Layer, soil. Horizons or strata. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Lime. Calcium carbonate, or calcium and magnesium carbonates.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Map unit. An area on the landscape that consists mainly of the soil or soils for which the unit is named. It includes minor areas of other soils. These areas are outlined on the soil map and identified by a symbol.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Montmorillonite. A fine, platy, alumino-silicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Opportunity time. The time that the soil is subject to wetting when irrigating.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Playa. A strongly saline old lake basin in the arid regions.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Porosity. The volume percentage of the soil mass that is made up of pores and cavities.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Pyroclastic material. Volcanic material and rock fragments that have been explosively ejected from a volcanic vent.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rhyolitic rocks. Fine grained, dense volcanic rocks with mineralogy similar to granitic rocks.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Riprap. A wall or foundation of loose stones.

Salic horizon. A soil layer more than 6 inches thick containing at least 2 percent soluble salts.

Saline classes. Soils are grouped on the basis of soil content. The degree of salinity is expressed as: *nonsaline* (less than 0.15 percent salt and less than 4 millimhos per centimeter conductivity of extract); *slightly saline* (0.15 to 0.35 percent salt and 4 to 8 millimhos per centimeter conductivity of extract); *moderately saline* (0.35 to 0.65 percent salt and 8 to 15 millimhos per centimeter conductivity of extract); and *strongly saline* (more than 0.65 percent salt and more than 15 millimhos per centimeter conductivity of extract).

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Shear strength, soil. Resistance of the soil mass to breaking or moving along a given plane.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. Slope names are as follows:

	Percent
Simple, nearly level; Complex, nearly level	0to 2
Simple, gentle sloping; Complex, undulating	2 to 5
Simple, moderately sloping; Complex, gently rolling	5 to 9
Simple, strongly sloping; Complex, rolling	9 to 15
Simple, moderately steep; Complex, hilly	15 to 30
Simple, steep; Complex, Steep	30 to 50
Simple, very steep; Complex, very steep	more than 50

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Soluble salts. Salts more soluble than gypsum is in cold water.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Tile drain. Concrete, ceramic, or plastic pipe placed at suitable depths and spacings in the soil or subsoil to provide water outlets from the soil.

Tile drain spacing. The distance between parallel tile lines in a grid design. Local classification of spacing for Imperial Valley for tile at a depth of 6 feet:

Closely spaced	40 to 80 feet
Moderately spaced	80 to 150 feet
Widely spaced	150 to 300 feet

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Trace elements. The chemical elements in soils, in only extremely small amounts, essential to plant growth. Examples are zinc, cobalt, manganese, copper, and iron.

Tuff. A compacted deposit 50 percent or more volcanic ash and dust.

Undifferentiated soil groups. Soil mapping units in which two or more similar taxonomic soil units occur, but there is little value in separating them.

Vesicular crust. A soil crust with many spherical or eliptical pores. Pores are commonly enclosed and not continuous.

Wash. Bed of an intermittent stream.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Windbreak. A planting of trees, shrubs, or other vegetation, usually perpendicular to the prevailing wind that protects soil, crops, homesteads, and roads from the effect of the wind and soil blowing.

ILLUSTRATIONS

Figure 1.—Stratified lakebed sediment (upper layers) is parent material of many Imperial Valley soils. Man's arms span a sandy layer probably reworked by wind before being buried.

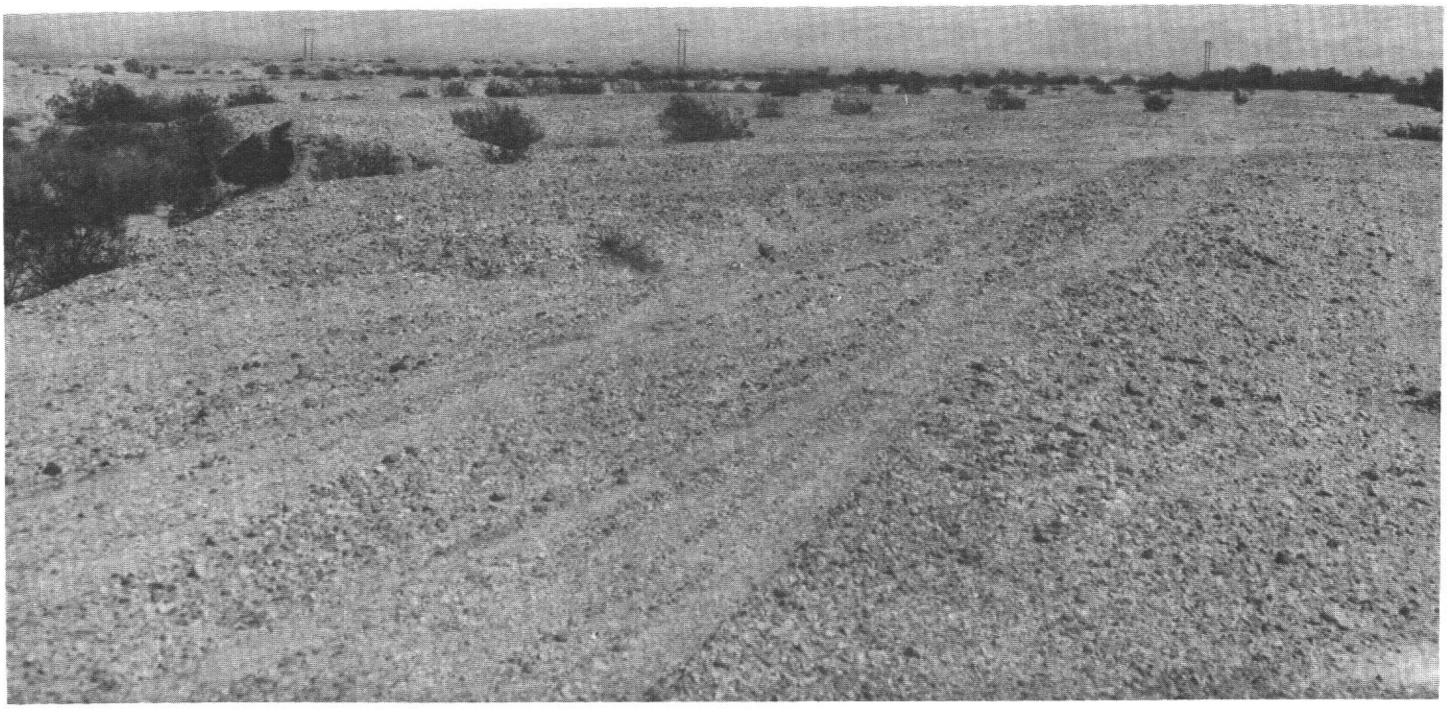

Figure 2.—Carsitas gravelly sand developed on gravelly alluvial fan from Chocolate Mountains.

Figure 3.—Entrenched river flood plain showing Fluvaquents, saline. Badlands on river bluffs in background.

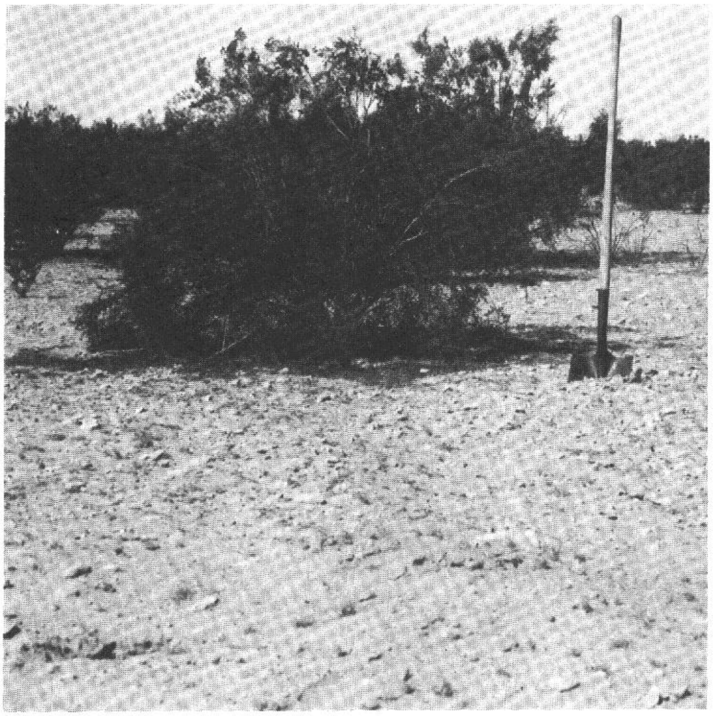

Figure 4.—Antho soil with creosotebushes and hardened lime nodules.

Figure 5.—Onions grown for seed on Glenbar clay loam, wet.

Figure 6.—Tilted strata of Glenbar complex in wall of storm drain.

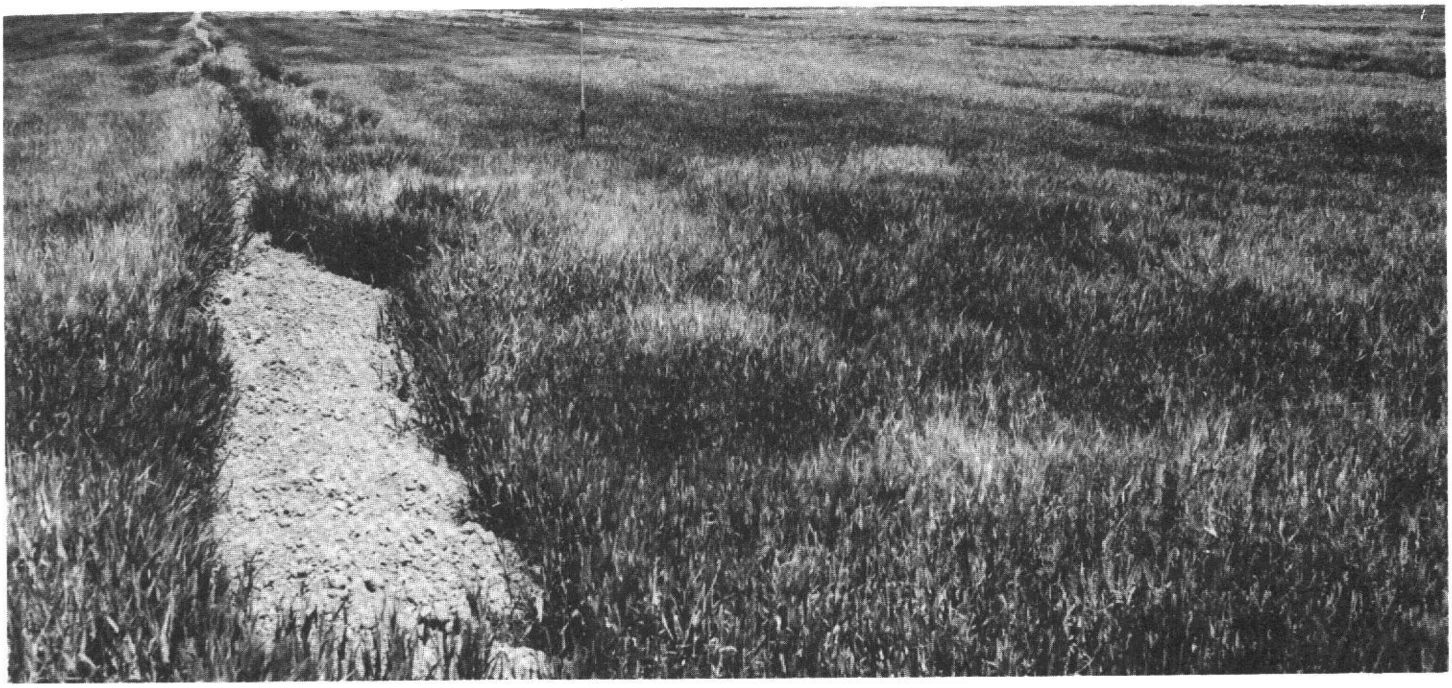

Figure 7.—Varying levels of salinity on Imperial silty clay, wet, cause uneven growth in the barley crop.

Figure 8.—Land leveling cut on Imperial-Glenbar silty clay loams.

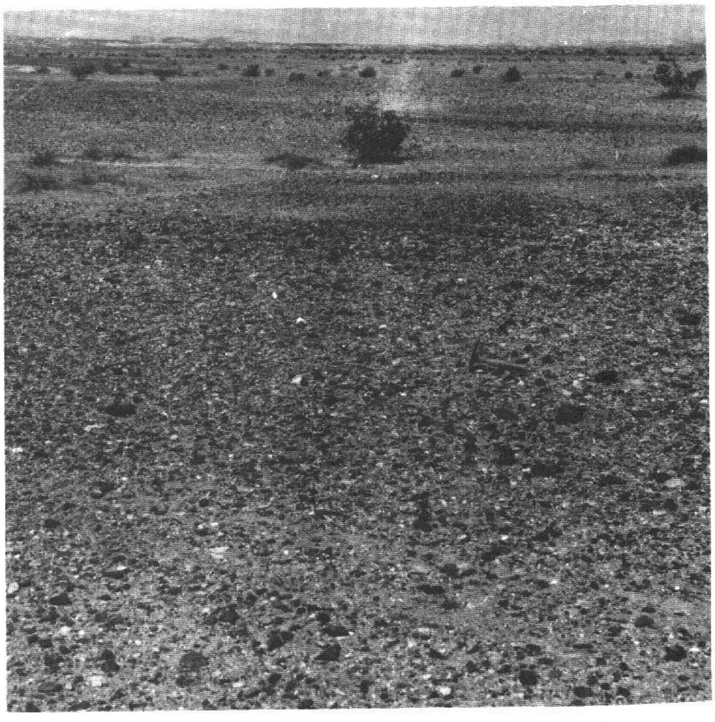

Figure 9.—Desert pavement and sparse vegetation on Laveen loam.

Figure 10.—Tomatoes on Meloland very fine sandy loam, wet.

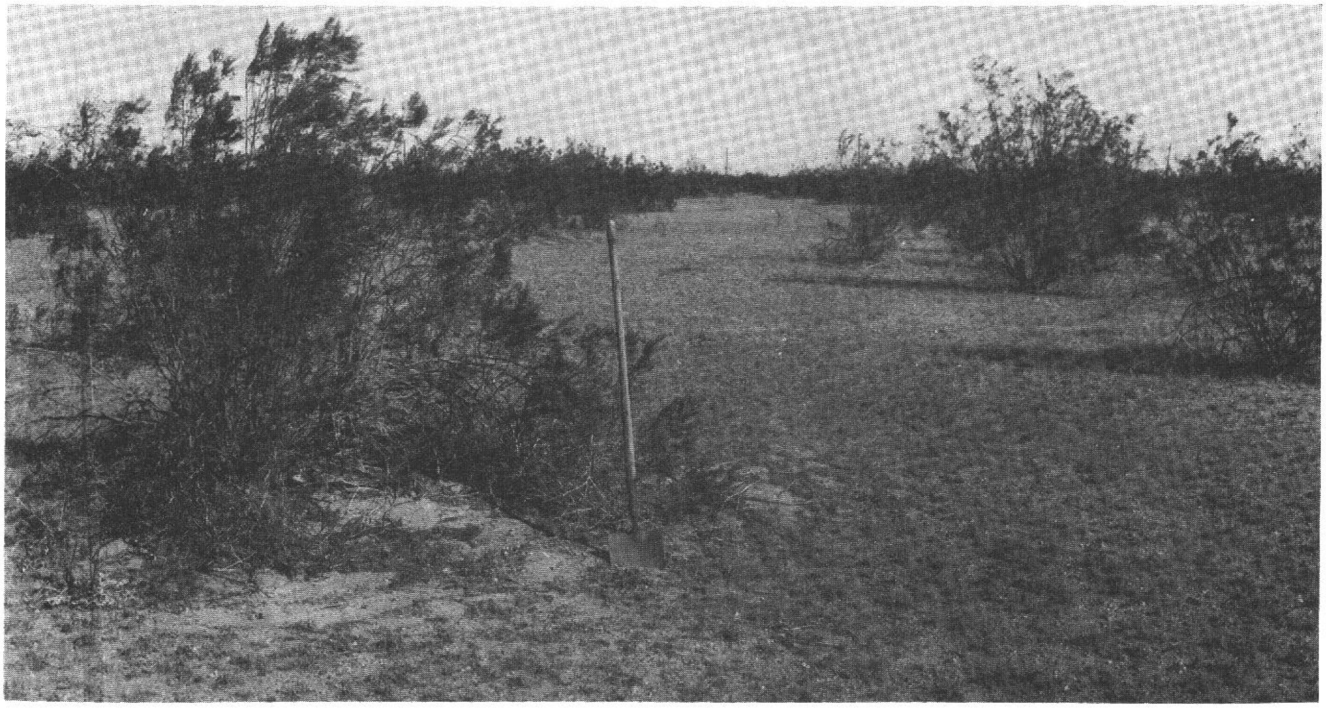

Figure 11.—Creosotebush, ephemeral herbs, grasses, pebbles, and lime nodules on Superstition loamy fine sand.

Figure 12.—Erosion caused by irrigation water escaping into a deep drainageway in Meloland and Holtville loams, wet.

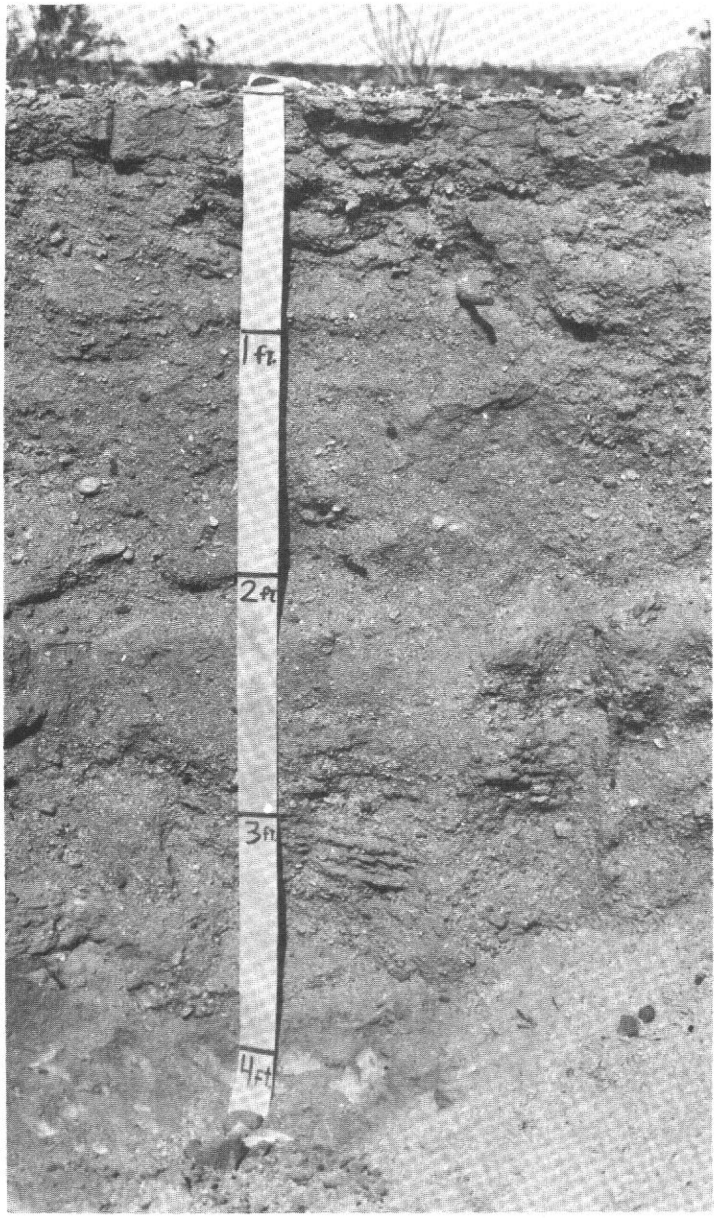

Figure 13.—Profile of Carsitas gravelly sand.

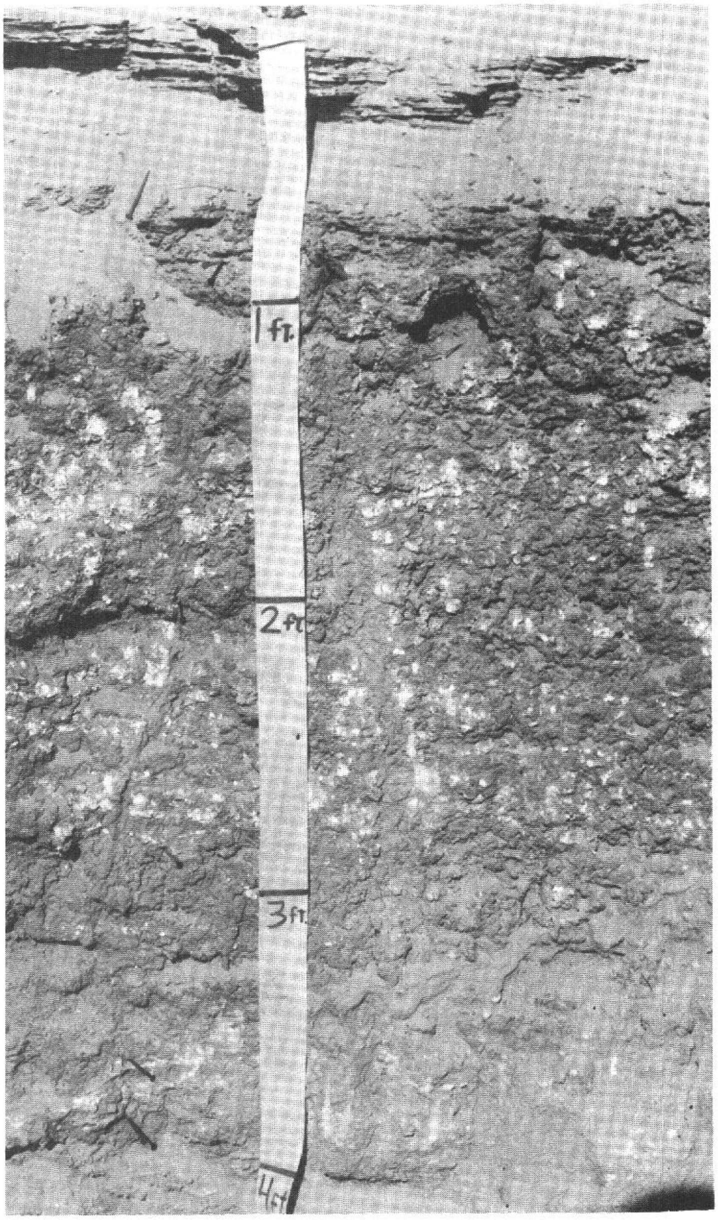

Figure 14.—Profile of Laveen loam. Note calcic horizon.

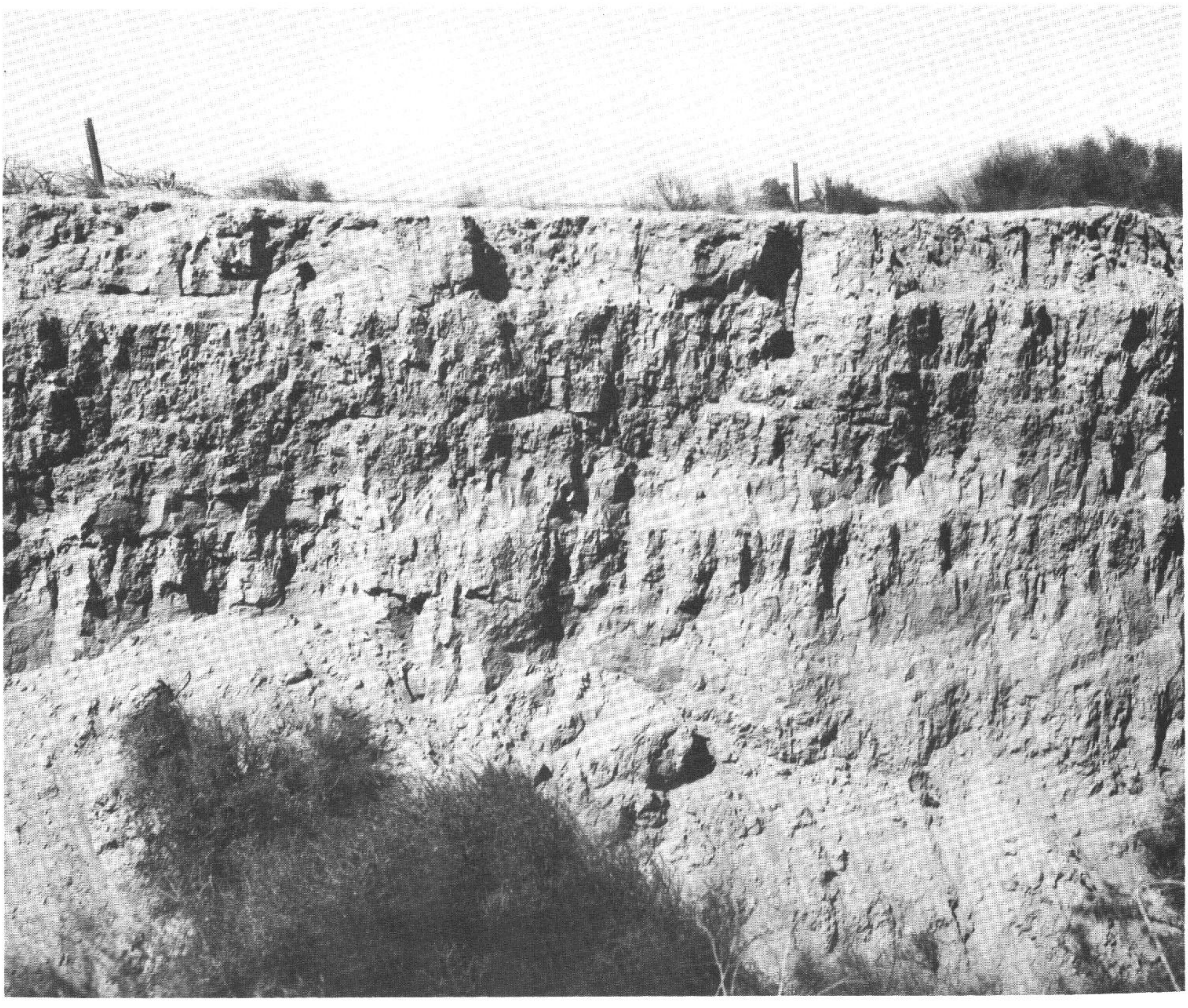

Figure 15.—Meloland soil on bluff at Salt Creek. Upper layers are stratified very fine sandy loam, loamy fine sand, and silt loam. Lower layers are silty clay.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature (degrees fahrenheit)					Precipitation (inches)		
				2 years in 10 will have at least 4 days--			1 year in 10 will have--	
	Average daily[1]	Average daily maximum[2]	Average daily minimum[2]	With max. temp. equal to or higher than--[2]	With min. temp. equal to or less than--[2]	Average monthly total[3]	Less than--	More than--
January	54	80	29	81	28	0.37	0.01	0.77
February	58	84	33	86	32	0.43	0.00	0.69
March	64	91	38	92	36	0.18	0.00	0.64
April	71	99	45	97	44	0.14	0.00	0.61
May	78	105	51	107	52	0.01	0.00	0.01
June	85	113	57	114	57	0.00	0.00	0.00
July	92	114	66	115	69	0.07	0.00	0.07
August	91	112	66	112	68	0.40	0.00	0.32
September	86	110	58	111	60	0.37	0.00	0.82
October	75	101	47	102	50	0.27	0.00	0.48
November	62	89	36	90	41	0.11	0.00	0.45
December	56	81	31	80	32	0.49	0.00	0.78
Year	73	---	---	116	28	2.4	1.0	3.4

[1]Climatological Data, California, Annual Summary, 1974, U.S. Dept. of Commerce.
[2]50-Year Summary, Records of Watermaster, Imperial Irrigation District.
[3]Climatological Data, California, Annual Summary, 1973, U.S. Dept. of Commerce.

TABLE 2.--FREEZE DATES IN SPRING AND FALL[1]

Probability	Temperature	
	32° F or lower	28° F or lower
Last freezing temperature in spring:		
1 year in 10 later than--	February 28	January 25
2 years in 10 later than--	February 18	January 10
5 years in 10 later than--	January 31	---
First freezing temperature in fall:		
1 year in 10 earlier than--	December 5	December 15
2 years in 10 earlier than--	December 10	December 25
5 years in 10 earlier than--	December 25	---

[1]Imperial Valley Weather Summary, 1962-1974, from Records of Watermaster, Imperial Irrigation District.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
100	Antho loamy fine sand	4,134	0.4
101	Antho-Superstition complex	8,416	0.9
102	Badland	4,390	0.4
103	Carsitas gravelly sand, 0 to 5 percent slopes	7,011	0.7
104	Fluvaquents, saline	12,262	1.2
105	Glenbar clay loam	2,951	0.3
106	Glenbar clay loam, wet	4,239	0.4
107	Glenbar complex	12,894	1.3
108	Holtville loam	2,804	0.3
109	Holtville silty clay	3,628	0.4
110	Holtville silty clay, wet	70,547	7.1
111	Holtville-Imperial silty clay loams	2,242	0.2
112	Imperial silty clay	1,405	0.1
113	Imperial silty clay, saline	5,679	0.6
114	Imperial silty clay, wet	123,401	12.5
115	Imperial-Glenbar silty clay loams, wet, 0 to 2 percent slopes	203,659	20.6
116	Imperial-Glenbar silty clay loams, 2 to 5 percent slopes	2,162	0.2
117	Indio loam	9,169	0.9
118	Indio loam, wet	13,625	1.4
119	Indio-Vint complex	29,643	3.0
120	Laveen loam	2,322	0.2
121	Meloland fine sand	10,748	1.1
122	Meloland very fine sandy loam, wet	41,734	4.2
123	Meloland and Holtville loams, wet	11,483	1.2
124	Niland gravelly sand	7,884	0.8
125	Niland gravelly sand, wet	9,820	1.0
126	Niland fine sand	2,846	0.3
127	Niland loamy fine sand	2,088	0.2
128	Niland-Imperial complex, wet	6,974	0.7
129	Pits	1,400	0.1
130	Rositas sand, 0 to 2 percent slopes	22,608	2.3
131	Rositas sand, 2 to 5 percent slopes	1,590	0.2
132	Rositas fine sand, 0 to 2 percent slopes	77,301	7.8
133	Rositas fine sand, 2 to 9 percent slopes	40,748	4.1
134	Rositas fine sand, 9 to 30 percent slopes	19,401	2.0
135	Rositas fine sand, wet, 0 to 2 percent slopes	22,626	2.3
136	Rositas loamy fine sand, 0 to 2 percent slopes	90,896	9.2
137	Rositas silt loam, 0 to 2 percent slopes	3,737	0.4
138	Rositas-Superstition loamy fine sands	11,373	1.2
139	Superstition loamy fine sand	12,887	1.3
140	Torriorthents-Rock outcrop complex, 5 to 60 percent slopes	462	*
141	Torriorthents and Orthids, 5 to 30 percent slopes	900	0.1
142	Vint loamy very fine sand, wet	31,545	3.2
143	Vint fine sandy loam	13,066	1.3
144	Vint and Indio very fine sandy loams, wet	15,462	1.6
	Water	3,288	0.3
	Total	989,450	100.0

* Less than 0.1 percent.

TABLE 4.--YIELDS PER ACRE OF IRRIGATED CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Alfalfa hay	Barley	Cantaloupe	Carrots	Cotton lint	Lettuce	Sugar beets
	Ton	Bu	Ton	Ton	Lb	Ton	Ton
105*: Glenbar	8.0	83	8	---	1,300	---	24
106: Glenbar	7.0	80	8	16	1,750	---	27
109, 110: Holtville	7	80	7	15	1,200	8	25
114: Imperial	5	75	5	10	1,000	6	23
115: Imperial	6.5	78	5	13	1,375	---	26
117: Indio	9	100	8	20	1,250	---	28
118: Indio	8	100	8	20	1,250	---	28
122: Meloland	7.5	80	7	18	---	9	24
123: Meloland	7	80	8	17	---	9	25
125: Niland	---	80	---	---	1,000	---	---
128: Niland	---	79	---	---	1,000	---	---
135: Rositas	7	60	5	12	1,000	---	---
142: Vint	6.5	95	7	18	1,750	---	25
144: Vint	7	97	7	19	1,530	---	26

* Yields are for areas protected from flooding.

TABLE 5.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
100: Antho	Slight	Slight	Slight	Slight	Slight.
101*:					
Antho	Slight	Slight	Slight	Slight	Slight.
Superstition	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
102*. Badland					
103: Carsitas	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
104*. Fluvaquents					
105: Glenbar	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
106: Glenbar	Moderate: wetness.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
107*: Glenbar	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
108, 109: Holtville	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
110: Holtville	Moderate: too clayey, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
111*:					
Holtville	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Imperial	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
112: Imperial	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
113: Imperial	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
114: Imperial	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
115*:					
Imperial	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
115*:					
Glenbar	Moderate: wetness.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
116*:					
Imperial	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Glenbar	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
117 Indio	Slight	Slight	Slight	Slight	Moderate: low strength.
118 Indio	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength.
119*:					
Indio	Slight	Slight	Slight	Slight	Moderate: low strength.
Vint	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.
120* Laveen	Slight	Slight	Slight	Slight	Slight.
121 Meloland	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Moderate: low strength.
122 Meloland	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Moderate: low strength, wetness.
123*:					
Meloland	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Moderate: low strength, wetness.
Holtville	Moderate: too clayey, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
124 Niland	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
125 Niland	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
126, 127 Niland	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
128*:					
Niland	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 5.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
128*:					
Imperial	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
130, 131, 132 Rositas	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
133 Rositas	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
134 Rositas	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
135 Rositas	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight.
136, 137 Rositas	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
138*:					
Rositas	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Superstition	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
139 Superstition	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
140*:					
Torriorthents					
Rock outcrop					
141*:					
Torriorthents					
Orthids					
142 Vint	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: low strength.
143 Vint	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength.
144*:					
Vint	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: low strength.
Indio	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
100 Antho	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
101*:					
Antho	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Superstition	Slight	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
102*. Badland					
103 Carsitas	Slight	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
104*. Fluvaquents					
105 Glenbar	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
106 Glenbar	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
107* Glenbar	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
108, 109 Holtville	Severe: percs slowly.	Severe: seepage.	Severe: too sandy.	Slight	Fair: too clayey.
110 Holtville	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: wetness, seepage.	Fair: too clayey.
111*:					
Holtville	Severe: percs slowly.	Severe: seepage.	Severe: too sandy.	Slight	Fair: too clayey.
Imperial	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
112 Imperial	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
113, 114 Imperial	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey.
115*:					
Imperial	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey.
Glenbar	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
116*:					
Imperial	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
116*:					
Glenbar	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
117 Indio	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
118 Indio	Severe: wetness.	Moderate: wetness, seepage.	Severe: wetness.	Moderate: wetness.	Good.
119*:					
Indio	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Vint	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
120* Laveen	Slight	Moderate: seepage.	Slight	Slight	Fair: area reclaim.
121 Meloland	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Slight	Poor: too clayey.
122 Meloland	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness, seepage.	Severe: seepage.	Poor: too clayey.
123*:					
Meloland	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness, seepage.	Severe: seepage.	Poor: too clayey.
Holtville	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness, seepage, too sandy.	Severe: seepage.	Fair: too clayey.
124 Niland	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
125 Niland	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Severe: wetness, too clayey.	Severe: seepage.	Poor: too sandy.
126, 127 Niland	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
128*:					
Niland	Severe: percs slowly, wetness.	Severe: seepage, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too sandy.
Imperial	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Moderate: wetness.	Poor: too clayey.
130, 131, 132, 133 Rositas	Slight	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
134 Rositas	Severe: slope.	Severe: seepage, slope.	Severe: too sandy.	Severe: slope.	Poor: slope, too sandy.
135 Rositas	Severe: wetness.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage.	Poor: too sandy.

See footnote at end of table.

TABLE 6.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
136, 137 Rositas	Slight	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
138*:					
Rositas	Slight	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
Superstition	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
139 Superstition	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
140*:					
Torriorthents					
Rock outcrop					
141*:					
Torriorthents					
Orthids					
142 Vint	Severe: wetness.	Severe: wetness, seepage.	Severe: wetness.	Moderate: wetness.	Poor: wetness.
143 Vint	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
144*:					
Vint	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: wetness.	Moderate: wetness.	Poor: wetness.
Indio	Severe: wetness, percs slowly.	Moderate: wetness, seepage.	Severe: wetness.	Moderate: wetness.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
100: Antho	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
101*:				
Antho	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
Superstition	Good	Poor: excess fines.	Unsuited	Poor: too sandy.
102*. Badland				
103: Carsitas	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy, small stones.
104*. Fluvaquents				
105: Glenbar	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.
106: Glenbar	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey, excess sodium.
107*: Glenbar	Poor: low strength.	Unsuited	Unsuited	Poor: excess salt, excess sodium.
108: Holtville	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
109, 110: Holtville	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
111*:				
Holtville	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Imperial	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
112: Imperial	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
113: Imperial	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, excess salt, excess sodium.
114: Imperial	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
115*:				
Imperial	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Glenbar	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey, excess sodium.
116*:				
Imperial	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Glenbar	Poor: low strength.	Unsuited	Unsuited	Fair: too clayey.
117, 118 Indio	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
119*:				
Indio	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Vint	Fair: low strength.	Poor: excess fines.	Unsuited	Poor: too sandy.
120* Laveen	Good	Unsuited	Unsuited	Good.
121 Meloland	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
122 Meloland	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair.
123*:				
Meloland	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair.
Holtville	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
124 Niland	Poor: low strength, shrink-swell.	Unsuited: thin layer, excess fines.	Unsuited: excess fines.	Poor: small stones, too sandy.
125 Niland	Poor: low strength, shrink-swell.	Unsuited: thin layer, excess fines.	Unsuited: excess fines.	Poor: too sandy, small stones.
126 Niland	Poor: low strength, shrink-swell.	Unsuited: thin layer, excess fines.	Unsuited: excess fines.	Poor: too sandy.
127 Niland	Poor: low strength, shrink-swell.	Unsuited: thin layer, excess fines.	Unsuited: excess fines.	Fair: too sandy, excess salt.
128*:				
Niland	Poor: low strength, shrink-swell.	Unsuited: thin layer, excess fines.	Unsuited: excess fines.	Poor: too sandy, small stones.

See footnote at end of table.

TABLE 7.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
128*:				
Imperial	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
130, 131, 132, 133 Rositas	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
134 Rositas	Fair: slope.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy, slope.
135 Rositas	Fair: wetness.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
136 Rositas	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
137 Rositas	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
138*:				
Rositas	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Superstition	Good	Poor: excess fines.	Unsuited	Fair: too sandy.
139 Superstition	Good	Poor: excess fines.	Unsuited	Fair: too sandy.
140*:				
Torriorthents				
Rock outcrop				
141*:				
Torriorthents				
Orthids				
142 Vint	Fair: wetness.	Poor: excess fines.	Unsuited	Poor: too sandy.
143 Vint	Fair: low strength.	Poor: excess fines.	Unsuited	Fair: thin layer.
144*:				
Vint	Fair: wetness.	Poor: excess fines.	Unsuited	Fair: thin layer, excess sodium.
Indio	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
100 Antho	Seepage	Piping	No water	Favorable	Droughty	Erodes easily.
101*:						
Antho	Seepage	Piping	No water	Favorable	Droughty	Erodes easily.
Superstition	Seepage	Seepage, piping.	No water	Cutbanks cave	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.
102*. Badland						
103 Carsitas	Seepage	Seepage	No water	Slope, cutbanks cave.	Slope, droughty, fast intake.	Too sandy, soil blowing.
104*. Fluvaquents						
105 Glenbar	Favorable	Low strength, piping.	No water	Floods, percs slowly.	Favorable	Piping.
106 Glenbar	Favorable	Low strength, piping.	Slow refill	Wetness, percs slowly, excess sodium.	Wetness, excess sodium.	Wetness, percs slowly.
107* Glenbar	Favorable	Low strength, piping.	No water	Floods, percs slowly, excess sodium.	Excess salt, excess sodium.	Piping.
108, 109 Holtville	Seepage	Hard to pack, piping.	No water	Percs slowly, cutbanks cave.	Percs slowly	Not needed.
110 Holtville	Seepage	Hard to pack, piping.	Deep to water	Percs slowly, cutbanks cave.	Percs slowly, wetness.	Not needed.
111*:						
Holtville	Seepage	Hard to pack, piping.	No water	Percs slowly, cutbanks cave.	Percs slowly	Not needed.
Imperial	Favorable	Hard to pack	No water	Percs slowly	Slow intake, percs slowly.	Erodes easily, percs slowly.
112 Imperial	Favorable	Hard to pack	No water	Percs slowly	Slow intake, percs slowly.	Erodes easily, percs slowly.
113 Imperial	Favorable	Hard to pack, piping.	Deep to water, slow refill.	Percs slowly, excess salt, excess sodium.	Percs slowly, excess sodium, excess salt.	Erodes easily, percs slowly.
114 Imperial	Favorable	Hard to pack	Slow refill, deep to water.	Percs slowly	Slow intake, percs slowly.	Erodes easily, percs slowly.
115*:						
Imperial	Favorable	Hard to pack	Slow refill, deep to water.	Percs slowly	Slow intake, percs slowly.	Erodes easily, percs slowly.
Glenbar	Favorable	Low strength, piping.	Slow refill	Wetness, percs slowly, excess sodium.	Wetness, excess sodium.	Wetness, percs slowly.
116*:						
Imperial	Favorable	Hard to pack	No water	Percs slowly	Slow intake, percs slowly.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
116*:						
Glenbar	Favorable	Low strength, piping.	No water	Floods, percs slowly.	Favorable	Piping.
117 Indio	Seepage	Piping	No water	Favorable	Soil blowing	Soil blowing.
118 Indio	Seepage	Piping	Deep to water	Favorable	Soil blowing	Soil blowing.
119*:						
Indio	Seepage	Piping	No water	Favorable	Soil blowing	Soil blowing.
Vint	Seepage	Low strength, piping, seepage.	No water	Cutbanks cave	Droughty, seepage.	Too sandy, piping.
120* Laveen	Seepage	Low strength, piping.	No water	Favorable	Favorable	Piping.
121 Meloland	Favorable	Hard to pack, piping.	No water	Percs slowly	Percs slowly, soil blowing, excess salt.	Percs slowly, soil blowing.
122 Meloland	Favorable	Piping, hard to pack.	Slow refill	Percs slowly, excess salt.	Percs slowly, wetness, soil blowing.	Wetness, percs slowly, soil blowing.
123*:						
Meloland	Favorable	Piping, hard to pack.	Slow refill	Percs slowly, excess salt.	Percs slowly, wetness, soil blowing.	Wetness, percs slowly, soil blowing.
Holtville	Seepage	Hard to pack, piping.	Deep to water	Percs slowly, cutbanks cave.	Percs slowly, wetness.	Not needed.
124 Niland	Favorable	Seepage, hard to pack.	No water	Percs slowly	Percs slowly, fast intake.	Too sandy.
125 Niland	Favorable	Seepage, hard to pack.	Slow refill	Percs slowly	Wetness, percs slowly, soil blowing.	Percs slowly, too sandy, soil blowing.
126, 127 Niland	Favorable	Seepage, hard to pack.	No water	Percs slowly	Percs slowly, fast intake.	Too sandy.
128*:						
Niland	Favorable	Seepage, hard to pack.	Slow refill	Percs slowly	Wetness, percs slowly, soil blowing.	Percs slowly, too sandy, soil blowing.
Imperial	Favorable	Hard to pack	Slow refill, deep to water.	Percs slowly	Slow intake, percs slowly.	Erodes easily, percs slowly.
130 Rositas	Seepage	Seepage, piping.	No water	Cutbanks cave	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
131 Rositas	Seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Droughty, fast intake, slope.	Too sandy, soil blowing.
132 Rositas	Seepage	Seepage, piping.	No water	Cutbanks cave	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
133 Rositas	Seepage	Seepage, piping.	No water	Slope, cutbanks cave.	Droughty, fast intake, slope.	Too sandy, soil blowing.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
134---------------- Rositas	Seepage, slope.	Seepage, piping.	No water--------	Slope, cutbanks cave.	Droughty, fast intake, slope.	Too sandy, slope, soil blowing.
135---------------- Rositas	Seepage---------	Seepage, piping.	Deep to water	Cutbanks cave, excess salt.	Wetness, droughty, fast intake.	Wetness, too sandy.
136, 137----------- Rositas	Seepage---------	Seepage, piping.	No water--------	Cutbanks cave	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
138*:						
Rositas-----------	Seepage---------	Seepage, piping.	No water--------	Cutbanks cave	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
Superstition------	Seepage---------	Seepage, piping.	No water--------	Cutbanks cave	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.
139---------------- Superstition	Seepage---------	Seepage, piping.	No water--------	Cutbanks cave	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.
140*:						
Torriorthents						
Rock outcrop						
141*:						
Torriorthents						
Orthids						
142---------------- Vint	Seepage---------	Seepage, piping, low strength.	Favorable-------	Wetness, excess sodium, cutbanks cave.	Wetness, excess sodium.	Wetness, piping.
143---------------- Vint	Seepage---------	Low strength, piping, seepage.	No water--------	Cutbanks cave	Droughty, seepage.	Too sandy, piping.
144*:						
Vint--------------	Seepage---------	Seepage, piping, low strength.	Favorable-------	Wetness, excess sodium, cutbanks cave.	Wetness, excess sodium.	Wetness, piping.
Indio-------------	Seepage---------	Piping----------	Deep to water	Favorable-------	Soil blowing----	Soil blowing.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
100 Antho	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy.	Moderate: too sandy.
101*:				
Antho	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy.	Moderate: too sandy.
Superstition	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
102*. Badland				
103 Carsitas	Severe: too sandy.	Severe: too sandy.	Severe: too sandy, small stones.	Severe: too sandy.
104*. Fluvaquents				
105 Glenbar	Slight	Slight	Moderate: too clayey.	Slight.
106 Glenbar	Slight	Slight	Moderate: too clayey.	Slight.
107* Glenbar	Slight	Slight	Slight	Slight.
108 Holtville	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
109 Holtville	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Severe: too clayey.	Moderate: too clayey, dusty.
110 Holtville	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
111*:				
Holtville	Moderate: dusty.	Moderate: dusty.	Moderate: too clayey, dusty.	Moderate: dusty.
Imperial	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
112, 113, 114 Imperial	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
115*:				
Imperial	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
Glenbar	Slight	Slight	Moderate: too clayey.	Slight.
116*:				
Imperial	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
116*:				
Glenbar	Slight	Slight	Moderate: too clayey.	Slight.
117, 118 Indio	Slight	Slight	Slight	Slight.
119*:				
Indio	Slight	Slight	Slight	Slight.
Vint	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
120* Laveen	Slight	Slight	Slight	Slight.
121 Meloland	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
122 Meloland	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
123*:				
Meloland	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Holtville	Slight	Slight	Slight	Slight.
124, 125, 126 Niland	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
127 Niland	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
128*:				
Niland	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Imperial	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
130, 131, 132 Rositas	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
133 Rositas	Severe: soil blowing.	Severe: soil blowing.	Severe: too sandy, slope.	Severe: soil blowing.
134 Rositas	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: soil blowing.
135 Rositas	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
136 Rositas	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
137 Rositas	Severe: dusty.	Severe: dusty.	Severe: dusty.	Severe: dusty.
138*:				
Rositas	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
Superstition	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
139 Superstition	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
140*:				
Torriorthents				
Rock outcrop				
141*:				
Torriorthents				
Orthids				
142 Vint	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
143 Vint	Slight	Slight	Slight	Slight.
144*:				
Vint	Slight	Slight	Slight	Slight.
Indio	Slight	Slight	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
100 Antho	Very poor	Very poor	Poor	Poor	Poor	Very poor	---	---	Poor.
101*:									
Antho	Very poor	Very poor	Poor	Poor	Poor	Very poor	---	---	Poor.
Superstition	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	---	Very poor	Very poor.
102*. Badland									
103 Carsitas	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
104*. Fluvaquents									
105 Glenbar	---	---	Poor	Poor	Poor	Very poor	---	Very poor	Poor.
106 Glenbar	Fair	Fair	Poor	Poor	Good	Good	Fair	Good	---
107 Glenbar	---	---	Poor	Poor	Poor	Very poor	---	Very poor	Poor.
108, 109 Holtville	Very poor	Very poor	Poor	Poor	---	---	---	---	Poor.
110 Holtville	Good	Good	Good	Fair	Fair	Fair	Good	Fair	---
111*:									
Holtville	Very poor	Very poor	Poor	Poor	---	---	---	---	Poor.
Imperial	Very poor	Very poor	Poor	Poor	---	---	---	---	Poor.
112 Imperial	Very poor	Very poor	Poor	Poor	---	---	---	---	Poor.
113 Imperial	Very poor	Very poor	Fair	Poor	Fair	Fair	Very poor	Fair	Poor.
114 Imperial	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair	---
115*:									
Imperial	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair	---
Glenbar	Fair	Fair	Poor	Poor	Good	Good	Fair	Good	---
116*:									
Imperial	Very poor	Very poor	Poor	Poor	---	---	---	---	Poor.
Glenbar	---	---	Poor	Poor	Poor	Very poor	---	Very poor	Poor.
117 Indio	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	---
118 Indio	Good	Good	Good	Good	Fair	Fair	Good	Fair	---

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
119*:									
Indio	Very poor	Very poor	Poor	Poor	Very poor	Very poor	---	Very poor	Poor.
Vint	---	---	Poor	Poor	Poor	Very poor	---	Very poor	Poor.
120* Laveen	Very poor	Very poor	Poor	Poor	Poor	Very poor	Very poor	Very poor	Poor.
121 Meloland	Very poor	Very poor	Poor	Poor	Very poor	Very poor	---	Very poor	Poor.
122 Meloland	Fair	Good	Good	Poor	Fair	Fair	Good	Fair	---
123*:									
Meloland	Fair	Good	Good	Poor	Fair	Fair	Good	Fair	---
Holtville	Good	Good	Good	Fair	Fair	Fair	Good	Fair	---
124 Niland	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
125 Niland	Fair	Fair	Good	Poor	Fair	Fair	Fair	Fair	---
126, 127 Niland	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
128*:									
Niland	Fair	Fair	Good	Poor	Fair	Fair	Fair	Fair	---
Imperial	Fair	Fair	Fair	Poor	Fair	Fair	Fair	Fair	---
130, 131, 132, 133, 134 Rositas	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	---	Very poor	Very poor.
135 Rositas	Fair	Fair	Good	Good	Good	Fair	Fair	Fair	---
136, 137 Rositas	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	---	Very poor	Very poor.
138*:									
Rositas	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	---	Very poor	Very poor.
Superstition	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	---	Very poor	Very poor.
139 Superstition	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	---	Very poor	Very poor.
140*:									
Torriorthents									
Rock outcrop									
141*:									
Torriorthents									
Orthids									
142 Vint	Fair	Fair	Poor	Poor	Good	Good	Fair	Good	---
143 Vint	---	---	Poor	Poor	Poor	Very poor	---	Very poor	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
144*:									
Vint	Fair	Fair	Poor	Poor	Good	Good	Fair	Good	---
Indio	Good	Good	Good	Good	Fair	Fair	Good	Fair	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
100------------- Antho	0-13	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	13-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
101*:											
Antho------------	0-8	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	8-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
Superstition------	0-6	Fine sand-------	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
102*. Badland											
103------------- Carsitas	0-10	Gravelly sand---	SP, SP-SM	A-1, A-2	0-5	60-90	50-85	30-55	0-10	---	NP
	10-60	Gravelly sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-5	60-90	50-85	25-50	0-10	---	NP
104* Fluvaquents											
105------------- Glenbar	0-13	Clay loam-------	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
106------------- Glenbar	0-13	Clay loam-------	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
107*------------- Glenbar	0-13	Loam------------	ML, CL-ML, CL	A-4	0	100	100	100	70-80	20-30	NP-10
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	75-95	35-45	15-30
108------------- Holtville	0-14	Loam------------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	14-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
109------------- Holtville	0-17	Silty clay------	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	17-24	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
110------------- Holtville	0-17	Silty clay------	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	17-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
111*:											
Holtville----------	0-10	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	10-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
Imperial----------	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
112---------------- Imperial	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
113---------------- Imperial	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay, clay, silty clay loam.	CH	A-7	0	100	100	100	85-95	50-70	25-45
114---------------- Imperial	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
115*:											
Imperial----------	0-12	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
Glenbar-----------	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
116*:											
Imperial----------	0-13	Silty clay loam	CL	A-7	0	100	100	100	85-95	40-50	10-20
	13-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
Glenbar-----------	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
117, 118----------- Indio	0-12	Loam------------	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-72	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
119*:											
Indio-------------	0-12	Loam------------	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-72	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
Vint--------------	0-10	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	25-35	---	NP
	10-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
120*--------------- Laveen	0-12	Loam------------	ML, CL-ML	A-4	0	100	95-100	75-85	55-65	20-30	NP-10
	12-60	Loam, very fine sandy loam.	ML, CL-ML	A-4	0	95-100	85-95	70-80	55-65	15-25	NP-10

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
121----------------- Meloland	0-12	Fine sand-------	SM, SP-SM	A-2, A-3	0	95-100	90-100	75-100	5-30	---	NP
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-65	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-40
122----------------- Meloland	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
123*:											
Meloland-----------	0-12	Loam-------------	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-38	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
	38-60	Stratified silt loam to loamy fine sand.	SM, ML	A-4	0	100	100	75-100	35-55	25-35	NP-10
Holtville----------	0-12	Loam-------------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	12-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-36	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	36-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
124, 125------------ Niland	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
126----------------- Niland	0-23	Fine sand-------	SM, SP-SM	A-2, A-3	0	90-100	90-100	50-65	5-25	---	NP
	23-60	Silty clay------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
127----------------- Niland	0-23	Loamy fine sand	SM	A-2	0	90-100	90-100	50-65	15-30	---	NP
	23-60	Silty clay------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
128*:											
Niland-------------	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-100	40-65	20-40
Imperial-----------	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
129*: Pits											
130, 131------------ Rositas	0-27	Sand-------------	SP-SM	A-3, A-1, A-2	0	100	80-100	40-70	5-15	---	NP
	27-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
132, 133, 134, 135-Rositas	0-9	Fine sand	SM	A-3, A-2	0	100	80-100	50-80	10-25	---	NP
	9-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
136-Rositas	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
137-Rositas	0-12	Silt loam	ML	A-4	0	100	100	90-100	70-90	20-30	NP-5
	12-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
138*:											
Rositas	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
Superstition	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
139-Superstition	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
140*:											
Torriorthents											
Rock outcrop											
141*:											
Torriorthents											
Orthids											
142-Vint	0-10	Loamy very fine sand.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-60	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
143-Vint	0-12	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-85	45-55	15-25	NP-5
	12-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
144*:											
Vint	0-10	Very fine sandy loam.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-40	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
	40-60	Silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
Indio	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-40	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	40-72	Silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
100	0-13	2.0-6.0	0.08-0.09	7.9-8.4	<4	Very low	0.17	5	2
Antho	13-60	2.0-6.0	0.08-0.12	7.9-8.4	<4	Low	0.32		
101*:									
Antho	0-8	2.0-6.0	0.08-0.09	7.9-8.4	<4	Very low	0.17	5	2
	8-60	2.0-6.0	0.08-0.12	7.9-8.4	<4	Low	0.32		
Superstition	0-6	2.0-6.0	0.05-0.11	7.9-8.4	<2	Low	0.15	5	2
	6-60	2.0-6.0	0.05-0.11	7.9-8.4	<2	Low	0.15		
102*. Badland									
103	0-10	6.0-20	0.03-0.06	7.4-8.4	<4	Low	0.10	5	1
Carsitas	10-60	6.0-20	0.03-0.06	7.4-8.4	<4	Low	0.10		
104*. Fluvaquents									
105	0-13	0.2-0.6	0.19-0.21	7.4-8.4	2-4	Moderate	0.37	5	4L
Glenbar	13-60	0.2-0.6	0.19-0.21	7.4-8.4	2-4	Moderate	0.37		
106	0-13	0.2-0.6	0.19-0.21	7.4-8.4	2-8	Moderate	0.37	5	4L
Glenbar	13-60	0.2-0.6	0.19-0.21	7.4-8.4	2-8	Moderate	0.37		
107*	0-13	0.6-2.0	0.13-0.15	8.5-9.0	4-8	Low	0.43	5	4L
Glenbar	13-60	0.2-0.6	0.16-0.18	8.5-9.0	>4	Moderate	0.43		
108	0-14	0.6-2.0	0.15-0.25	7.4-8.4	2-8	Low	0.43	5	4L
Holtville	14-22	0.06-0.2	0.17-0.25	7.4-8.4	2-8	High	0.32		
	22-60	0.6-2.0	0.15-0.25	7.4-8.4	2-8	Low	0.43		
109, 110	0-17	0.06-0.2	0.17-0.25	7.4-8.4	2-8	High	0.32	5	4
Holtville	17-24	0.06-0.2	0.17-0.25	7.4-8.4	2-8	High	0.32		
	24-35	0.6-2.0	0.15-0.25	7.4-8.4	2-8	Low	0.43		
	35-60	2.0-6.0	0.08-0.10	7.4-8.4	2-8	Low	0.28		
111*:									
Holtville	0-10	0.06-0.2	0.17-0.25	7.4-8.4	2-8	High	0.32	5	4
	10-22	0.06-0.2	0.17-0.25	7.4-8.4	2-8	High	0.32		
	22-60	0.6-2.0	0.15-0.25	7.4-8.4	2-8	Low	0.43		
Imperial	0-12	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High	0.43	5	4
	12-60	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High	0.43		
112	0-12	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High	0.43	5	4
Imperial	12-60	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High	0.43		
113	0-12	0.06-0.2	0.06-0.17	8.5-9.0	>8	High	0.43	5	4
Imperial	12-60	0.06-0.2	0.06-0.17	8.5-9.0	>8	High	0.43		
114	0-12	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High	0.43	5	4
Imperial	12-60	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High	0.43		
115*:									
Imperial	0-12	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High	0.43	5	4
	12-60	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High	0.43		
Glenbar	0-13	0.2-0.6	0.19-0.21	7.9-8.4	2-8	Moderate	0.37	5	4L
	13-60	0.2-0.6	0.19-0.21	7.9-8.4	2-8	Moderate	0.37		

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
116*:									
Imperial--------	0-13	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High------	0.43	5	4
	13-60	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High------	0.43		
Glenbar---------	0-13	0.2-0.6	0.19-0.21	7.9-8.4	2-4	Moderate	0.37	5	4L
	13-60	0.2-0.6	0.19-0.21	7.9-8.4	2-4	Moderate	0.37		
117, 118--------- Indio	0-12	0.6-2.0	0.18-0.20	7.9-8.4	<4	Low-------	0.55	5	4L
	12-72	0.6-2.0	0.16-0.20	7.9-8.4	<4	Low-------	0.49		
119*:									
Indio-----------	0-12	0.6-2.0	0.18-0.20	7.9-8.4	<4	Low-------	0.55	5	4L
	12-72	0.6-2.0	0.16-0.20	7.9-8.4	<4	Low-------	0.49		
Vint------------	0-10	2.0-6.0	0.09-0.11	7.9-8.4	2-4	Low-------	0.24	4	2
	10-60	2.0-6.0	0.09-0.11	7.9-8.4	2-4	Low-------	0.24		
120*------------- Laveen	0-12	0.6-2.0	0.16-0.18	7.9-8.4	<4	Low-------	0.37	4	4L
	12-60	0.6-2.0	0.16-0.18	7.9-8.4	<4	Low-------	0.43		
121-------------- Meloland	0-12	2.0-6.0	0.08-0.09	7.4-8.4	2-8	Low-------	0.28	5	1
	12-26	0.6-2.0	0.08-0.25	7.4-8.4	2-8	Low-------	0.43		
	26-71	0.06-0.2	0.06-0.15	7.4-8.4	8-16	High------	0.32		
122-------------- Meloland	0-12	0.6-2.0	0.15-0.25	7.4-8.4	2-8	Low-------	0.43	5	4L
	12-26	0.6-2.0	0.08-0.25	7.4-8.4	2-8	Low-------	0.43		
	26-71	0.06-0.2	0.06-0.15	7.4-8.4	8-16	High------	0.32		
123*:									
Meloland--------	0-12	0.6-2.0	0.15-0.25	7.4-8.4	2-8	Low-------	0.43	5	4L
	12-26	0.6-2.0	0.08-0.25	7.4-8.4	2-8	Low-------	0.43		
	26-38	0.06-0.2	0.06-0.15	7.4-8.4	8-16	High------	0.32		
	38-60	0.6-2.0	0.08-0.25	7.4-8.4	8-16	Low-------	0.43		
Holtville-------	0-12	0.6-2.0	0.15-0.25	7.4-8.4	2-8	Low-------	0.43	5	4L
	12-24	0.06-0.2	0.17-0.25	7.4-8.4	2-8	High------	0.32		
	24-36	0.6-2.0	0.15-0.25	7.4-8.4	2-8	Low-------	0.43		
	36-60	2.0-6.0	0.08-0.10	7.4-8.4	2-8	Low-------	0.28		
124, 125--------- Niland	0-23	6.0-20	0.04-0.06	7.9-8.4	2-8	Low-------	0.24	5	1
	23-60	0.06-0.2	0.10-0.16	7.9-8.4	2-16	High------	0.32		
126, 127--------- Niland	0-23	6.0-20	0.06-0.08	7.9-8.4	2-8	Low-------	0.28	5	2
	23-60	0.06-0.2	0.10-0.16	7.9-8.4	2-16	High------	0.32		
128*:									
Niland----------	0-23	6.0-20	0.04-0.06	7.9-8.4	2-8	Low-------	0.24	5	1
	23-60	0.06-0.2	0.10-0.16	7.9-8.4	2-16	High------	0.32		
Imperial--------	0-12	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High------	0.43	5	4
	12-60	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High------	0.43		
129*. Pits									
130, 131, 132, 133, 134-------- Rositas	0-9	6.0-20	0.05-0.07	7.9-8.4	2-4	Low-------	0.20	5	1
	9-60	6.0-20	0.05-0.08	7.9-8.4	2-4	Low-------	0.20		
135-------------- Rositas	0-9	6.0-20	0.05-0.07	7.9-8.4	2-8	Low-------	0.20	5	1
	9-60	6.0-20	0.05-0.08	7.9-8.4	2-8	Low-------	0.20		
136-------------- Rositas	0-4	6.0-20	0.06-0.08	7.9-8.4	2-4	Low-------	0.20	5	2
	4-60	6.0-20	0.05-0.08	7.9-8.4	2-4	Low-------	0.20		
137-------------- Rositas	0-12	0.6-2.0	0.20-0.25	7.9-8.4	2-4	Low-------	0.49	5	4L
	12-60	6.0-20	0.05-0.08	7.9-8.4	2-4	Low-------	0.20		
138*:									
Rositas---------	0-4	6.0-20	0.06-0.08	7.9-8.4	2-4	Low-------	0.20	5	2
	4-60	6.0-20	0.05-0.08	7.9-8.4	2-4	Low-------	0.20		

See footnote at end of table.

TABLE 12.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
138*:									
Superstition----	0-6	2.0-6.0	0.05-0.11	7.9-8.4	<2	Low-------	0.15	5	2
	6-60	2.0-6.0	0.05-0.11	7.9-8.4	<2	Low-------	0.15		
139-------------- Superstition	0-6	2.0-6.0	0.05-0.11	7.9-8.4	<2	Low-------	0.15	5	2
	6-60	2.0-6.0	0.05-0.11	7.9-8.4	<2	Low-------	0.15		
140*:									
Torriorthents									
Rock outcrop									
141*:									
Torriorthents									
Orthids									
142-------------- Vint	0-10	2.0-6.0	0.10-0.20	7.9-8.4	2-8	Low-------	0.32	5	3
	10-60	2.0-6.0	0.09-0.11	7.9-8.4	2-8	Low-------	0.17		
143-------------- Vint	0-12	0.6-2.0	0.13-0.15	7.9-8.4	2-4	Low-------	0.37	4	3
	12-60	2.0-6.0	0.09-0.11	7.9-8.4	2-4	Low-------	0.24		
144*:									
Vint------------	0-10	2.0-6.0	0.10-0.20	7.9-8.4	2-8	Low-------	0.32	5	3
	10-40	2.0-6.0	0.09-0.11	7.9-8.4	2-8	Low-------	0.17		
	40-60	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High------	0.43	5	3
Indio-----------	0-12	0.6-2.0	0.18-0.20	7.9-8.4	<4	Low-------	0.55	5	4L
	12-40	0.6-2.0	0.16-0.20	7.9-8.4	<4	Low-------	0.49		
	40-70	0.06-0.2	0.17-0.35	7.9-8.4	4-8	High------	0.43		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	High water table			Risk of corrosion	
		Depth	Kind	Months	Uncoated steel	Concrete
		Ft				
100------------- Antho	B	>6.0	---	---	High	Low.
101*:						
Antho	B	>6.0	---	---	High	Low.
Superstition	A	>6.0	---	---	High	Low.
102*. Badland						
103 Carsitas	A	>6.0	---	---	High	Low.
104*. Fluvaquents						
105 Glenbar	B	>6.0	---	---	High	Moderate.
106 Glenbar	B	3.0-5.0	Perched	Jan-Dec	High	Moderate.
107* Glenbar	B	>6.0	---	---	High	High.
108, 109 Holtville	C	>6.0	---	---	High	Low.
110 Holtville	C	3.0-5.0	Perched	Jan-Dec	High	Moderate.
111*:						
Holtville	C	>6.0	---	---	High	Low.
Imperial	D	>6.0	---	---	High	Moderate.
112 Imperial	D	>6.0	---	---	High	Moderate.
113 Imperial	D	3.0-5.0	Perched	Jan-Dec	High	High.
114 Imperial	D	3.0-5.0	Perched	Jan-Dec	High	Moderate.
115*:						
Imperial	D	3.0-5.0	Perched	Jan-Dec	High	Moderate.
Glenbar	B	3.0-5.0	Perched	Jan-Dec	High	Moderate.
116*:						
Imperial	D	>6.0	---	---	High	Moderate.
Glenbar	B	>6.0	---	---	High	Moderate.
117 Indio	B	>6.0	---	---	High	Low.
118 Indio	B	3.0-5.0	Perched	Jan-Dec	High	Low.

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	High water table			Risk of corrosion	
		Depth	Kind	Months	Uncoated steel	Concrete
		Ft				
119*:						
Indio	B	>6.0	---	---	High	Low.
Vint	B	>6.0	---	---	High	Low.
120* Laveen	B	>6.0	---	---	High	Low.
121 Meloland	C	>6.0	---	---	High	Moderate.
122 Meloland	C	2.0-3.0	Perched	Jan-Dec	High	Moderate.
123*:						
Meloland	C	2.0-3.0	Perched	Jan-Dec	High	Moderate.
Holtville	C	3.0-5.0	Perched	Jan-Dec	High	Moderate.
124 Niland	C	>6.0	---	---	High	Moderate.
125 Niland	C	2.0-3.0	Perched	Jan-Dec	High	Moderate.
126, 127 Niland	C	>6.0	---	---	High	Moderate.
128*:						
Niland	C	2.0-3.0	Perched	Jan-Dec	High	Moderate.
Imperial	D	3.0-5.0	Perched	Jan-Dec	High	Moderate.
130, 131, 132, 133, 134 Rositas	A	>6.0	---	---	High	Low.
135 Rositas	A	3.0-5.0	Perched	Jan-Dec	High	Moderate.
136, 137 Rositas	A	>6.0	---	---	High	Low.
138*:						
Rositas	A	>6.0	---	---	High	Low.
Superstition	A	>6.0	---	---	High	Low.
139 Superstition	A	>6.0	---	---	High	Low.
140*:						
Torriorthents						
Rock outcrop						
141*:						
Torriorthents						
Orthids						
142 Vint	B	3.0-5.0	Perched	Jan-Dec	High	Moderate.
143 Vint	B	>6.0	---	---	High	Low.

See footnote at end of table.

TABLE 13.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	High water table			Risk of corrosion	
		Depth	Kind	Months	Uncoated steel	Concrete
		Ft				
144*:						
Vint	B	3.0-5.0	Perched	Jan-Dec	High	Moderate.
Indio	B	3.0-5.0	Perched	Jan-Dec	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
*Antho	Coarse-loamy, mixed (calcareous), hyperthermic Typic Torrifluvents
Carsitas	Mixed, hyperthermic Typic Torripsamments
Glenbar	Fine-silty, mixed (calcareous), hyperthermic Typic Torrifluvents
Holtville	Clayey over loamy, montmorillonitic (calcareous), hyperthermic Typic Torrifluvents
Imperial	Fine, montmorillonitic (calcareous), hyperthermic Vertic Torrifluvents
Indio	Coarse-silty, mixed (calcareous), hyperthermic Typic Torrifluvents
Laveen	Coarse-loamy, mixed, hyperthermic Typic Calciorthids
Meloland	Coarse-loamy over clayey, mixed (calcareous), hyperthermic Typic Torrifluvents
Niland	Sandy over clayey, mixed (calcareous), hyperthermic Typic Torrifluvents
Rositas	Mixed, hyperthermic Typic Torripsamments
Superstition	Sandy, mixed, hyperthermic Typic Calciorthids
Vint	Sandy, mixed, hyperthermic Typic Torrifluvents

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